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ARTIFICIAL DENTURES

&

VULCANITE WORK.

BY

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WITH NUMEROUS ORIGINAL ILLUSTRATIONS.

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Artificial Dentures front.

ARTIFICIAL DENTURES.

By HARRY ROSE, L.D.S. Eng:

To estimate artificial teeth at their full value, one must consider firstly, the nature of the requirements expected from them, and secondly, whether they fulfil those requirements in a fairly satisfactory manner.

The object in wearing artificial substitutes for the lost natural teeth is, of course, to improve the power of mastication, to give clearness and distinctness to the speech, and to restore to the features the particular character of expression existing before the removal or decay of those essential though ofttimes troublesome occupants of the dental arches.

That these conditions are fulfilled in a very efficient manner in a great number of cases, no one, I think, will attempt to deny ; in fact, it is only those who have lost their own natural teeth who can adequately realise the benefits to be derived from a good fitting and well made set of artificial teeth. The wearer in a few days, or at farthest in a week or two, should be able to articulate more distinctly, to masticate his food in a thoroughly efficient manner, and find that his great enemy indigestion is becoming a thing of the past.

Having arrived at this stage, if the artist has shown the necessary care and skill in construction, the patient ought to forget their presence in the mouth, and scarcely to be aware that they are other than his own natural organs.

Artificial teeth can be made so comfortable that not infrequently the possessor is unaware of their absence from the mouth until he begins to eat, and the exclamation at the breakfast table, "Dear me! I have forgotten to put in my teeth this morning," is not by any means an uncommon occurrence.

I have spoken of work being properly constructed, and would state that a marked difference exists between an artistic denture and the clumsy masses of vulcanite too often offered to the public under the name of artificial teeth.

An artistic case should really be a reproduction of the roof of the mouth and the natural teeth, that is to say, the vulcanite or plate should represent a setting for the teeth and should conform to, and copy, the surface of the gum on its lingual as well as palatine aspect.

The rugæ should be accurately represented, and the case should not present a smooth and unbroken continuity of surface which certainly does not conform to, nor represent the roof of the mouth.

It is this latter which sometimes makes the wearer declare that his food seems to slip down his throat before he has had time to masticate it properly, and it is the thickness of the case which gets in the way of the tongue, fills up the mouth and renders articulation so difficult and indistinct.

The tongue is seeking for contact with its lost bearings, and instead of finding them discovers a smooth and unbroken surface.

Another thing I would mention is, as to the shaping of the

backs of teeth to represent the natural ones, and again these are found to be separated at their necks by an interval, clear and distinct in shape.

By attempting a close approach to Nature in our efforts at dental reparation one ought to be rewarded by the patient more quickly tolerating the presence of the case in the mouth and appreciating the result of the dentist's labour, not as mere mechanical work, but as the outcome of a science.

Fitting Teeth in the Mouth.

No part of our work requires so much patience, tact, and judgment as the subject under discussion, viz., adjusting cases to the mouth.

One must be able to grasp and overcome every little trouble and difficulty likely to arise, and to do this successfully it is necessary to understand and appreciate the various sensations that a patient is likely to be subjected to when artificial teeth are placed in the mouth for the first time.

The first and foremost is the feeling of having too much in the mouth, and that there is no room for the tongue; this is the primary complaint one can persuade a patient to bear with, if another objection does not crop up, that is, the size of the plate creating nausea. It is then that one requires all the discretion and judgment possible in order to abstain from reducing the case, or if reducing it that one does not impair its stability by suction.

One may have to call into aid all one's persuasive power to get the patient to wear the case if only for a single night that the tongue may get used to the foreign body in the mouth.

I say one night for this reason, that while the patient is asleep, the tongue accommodates itself readily to its more limited space than by wearing the work a week in the day

time only ; and when the case is reduced somewhat in size, if necessary, after once wearing it the tongue and palate at once recognise the alteration however slight that has been made, and the patient finds immediate relief.

The next troubles may be enumerated as having reference to the stability of the cases in the mouth, learning to masticate with them, and another item I must not omit, viz., the general depression of the patient at not being able to accomplish all these essentials at once.

Now as regards the stability or holding power of the work in the mouth. I must conclude that the student understands his work and has taken the precautions enumerated to obtain the best results ; if he has done so he should feel quite satisfied in his own mind that he has made the case properly, and should then be able to assure the patient, that perseverance in wearing it is alone necessary to ensure success.

Let us surmise that the case has been worn for a few days, and the patient returns to give his report.

He begins by stating that he cannot eat with them, and that they make the mouth very sore. It is astonishing what a trouble one patient will make of a small sore in the mouth while another whose mouth bears evidence of still greater pressure will scarcely mind it in the least.

It is now clear that one must take a little from the case where it unduly presses, and should at the same time touch the ulcerated spots with silver nitrate which cauterises and leaves a deadened surface protecting the parts below or above, and allows them to heal readily.

This soreness of the mouth is not a bad sign, and should rather be welcomed by the dentist as evidence that the case has been worn and to some extent used, and at the same time the patient should be made to understand that one

cannot expect any great amount of masticating power until the mouth has educated itself to wearing the work, and the teeth are able to close forcibly without causing pain.

I would here mention that directions should be given to the patient to wear the case until the mouth is sore and then present himself. One can then examine the mouth and relieve the case accurately, and at the same time the trouble will have been anticipated and his mind relieved, for it is only natural when the mouth becomes more and more tender, and difficulties seem to increase rather than diminish, that the patient should imagine that the case is not well made, and things are going wrong.

Any little soreness of the mucous tissues soon heals up again when the undue pressure is removed, and one may have a patient down in the dumps, so to speak, one visit, and on the next occasion expressing himself as being absolutely comfortable.

It should be made a golden rule on the insertion of teeth, to inform the patient of the various difficulties he is liable to encounter, and must overcome, before growing accustomed to the case, and that it is expected he will visit you until he is quite comfortable. Nothing distresses me more, and it is doubtless the same with any conscientious dentist, than a patient returning after a few months saying he is not wearing the work and has never been able to.

Now as the gums get more used to the pressure of the work, and if the patient has been intelligent enough by cutting up the food, especially meat, pretty small, to give so much help to the set, mastication becomes more and more perfect, and ultimately he finds himself in possession of a dental armature that he can do anything in reason with.

Before closing this part of the subject I would draw the

attention of the young practitioner to the fact that his patients are not all constituted alike, some can tolerate anything in the mouth, while others are rendered miserable by a trifle, or what we regard as such. One must humour some, encourage others, and above all please oneself, and feel assurred that the work is well done and is in every respect suitable, for the patient's welfare ; if anything has been omitted in its construction, it is always better to recognize it at once, and remake the case, if necessary, instead of allowing the patient to have all the annoyance ultimately to find out that the lteration has to be effected after all.

PREPARATION OF THE MOUTH.

When a patient seeks our aid for artificial teeth, our first duty is to examine the mouth and give a candid and honest opinion as to its condition, also to point out and explain the necessity for the various operations to be undergone, and the amount of discomfort likely to attend the same.

We must in a word, educate our patients in dentistry, and let them clearly understand what we intend doing ; it gives them not only a higher appreciation of the difficulties of our work, but it establishes their confidence in the dentist, and in the efforts he is making for their comfort. If this is done in a proper spirit, and conveyed to the patient's mind in a proper manner, there can be, I think, no ethical objection taken.

Prior to any operation it may be necessary in some cases to take an impression of those teeth remaining in situ, in order to give us a correct idea of their shape, length and position, so that in the construction of our artificial denture we may make the teeth conform to the original natural organs

we intend removing. The temporary impressions, may be taken in beeswax, that being the least objectionable material used for this purpose, and will give a sufficiently good cast for our guidance.

Having obtained the temporary impressions, the next care must be the removal of roots and useless teeth, and one of the greatest difficulties one has to encounter in private practice is that of inducing patients to submit to this preliminary.

If the operation is to be performed under gas, I strongly advise the extraction of the most difficult and painful first, as it frequently happens that the patieut will submit to the extraction of the least painful without gas, besides one is then in a position to assure him that the worst is over. On the other hand if the operation is to be performed without the aid of an anæsthetic, then I would advise the removal of the least important roots at the back of the mouth, for I find as a rule, patients begin to screw up their courage on finding it not nearly so bad as they imagined, and if the latter part of the operation is more than they can bear, they are more easily persuaded to have gas ; or if they still object to that, it is better the roots should be left in the front of the mouth than at the back, those not being subject to such rapid disintegration and decay, and are at the same time more easy and reliable to fill, and can at any rate be made somewhat presentable.

After allowing the patient a few days' rest, any teeth that may require it, should be filled, and all traces of tartar removed.

The patient should be instructed to gargle the mouth with some astringent, such as tannin or myrrh, using for the first few days a weak solution of permanganate of potash as well, in order to cleanse and disinfect the cavities left by the

removal of the roots and teeth, as they are apt to become filled with particles of food and broken down tissues, and rendered offensive, so retarding the healing process.

It often becomes a difficult problem to solve, which teeth to remove and which to retain, and I am afraid one cannot make any hard and fast rule, for it is necessary to take into consideration the character of teeth, the age of the patient and also whether those teeth one wishes to retain will last an appreciable time.

When one has an aged patient to treat, it may be wise to preserve as many teeth as possible, in order that he may not suffer more inconvenience than is absolutely necessary, and also to aid in the retention of the work.

On the other hand if the patient is young, and the remaining teeth are of a frail chalky character, and not likely to have a long existence, it would be the wisest and best course and more conducive to the future well-being of the patient to extract all the teeth and get the mouth into a thoroughly sound and healthy condition.

Speaking from actual personal experience, I would emphasize the fact that next to having a good natural set of one's own with which to perform nature's offices, the next best thing for our economy is a perfect artificial denture ; none but wearers can appreciate the advantages resulting therefrom.

Loose teeth are of no use to us for the purposes of fastenings or clasps, and the result of their condition causes a certain amount of irritation and swelling of the adjacent mucous membrane, and is detrimental to the fit of the case.

The same objection holds good with regard to roots being covered over by the plate ; they are generally the exciting cause of local disturbance and if they are not filled, their

presence is indicated by the foul and fœtid breath of the patient.

If a rule could be made, I would counsel in every case the removal of roots, unless they were of an unexceptionally healthy and reliable character, or could be rendered so by conservative treatment such as capping and crowning so as to assist materially in the retention of a denture.

Now as this treatment of roots involves a considerable expenditure of time, skill, and patience, on the part of the dentist, it should also command an adequate recompense from the patient. Therefore, to prevent any misunderstanding with respect to fees, a perfectly honest and straightforward statement of what is to be done should be submitted to him, so that in the event of his not being willing, or able, to afford such an expensive operation, he can by having the roots removed, and allowing the mouth time to heal, have an equally reliable, but less costly denture.

But where one finds one sensible patient, one meets with fifty who seem to know more about dentistry than the dentist, and strongly object to such removal, at the same time mentioning various friends who have had cases made without any interference with the roots.

The only course that is left open is to throw all the blame of bad after-consequences upon their shoulders, and if one has occasion to leave roots in the mouth, one must do his best by filing them level with the gums, and filling the canals in them with oxy-phosphate or gutta-percha to avoid at least some of the evils of their retention.

All good strong teeth likely to aid in the retention of the case should of course be preserved. A solitary tooth especially in the upper jaw is best away, but in the lower it may be useful in opposing the denture in its tendency to slip for-

wards. Teeth that have lost their antagonists and risen from their sockets should be extracted ; they can fulfil no useful purpose, and only render unsightly an otherwise pretty and artistic case.

It is a question often asked, how long should the gums be allowed to absorb and harden after the removal of teeth. One response can be made that it all depends upon the severity of the operation and may be reckoned from three weeks to six months or even longer ; it all depends whether a temporary or permanent case is contemplated.

I do not think the dentist is justified in allowing his patient to remain for even a period of three months after unfurnishing his mouth without furnishing it again ; he loses to a great extent the original facial expression, and it takes a much longer time to become accustomed to the feel of the denture than if it were inserted as quickly after the extraction of the teeth as possible, setting aside the inconvenience and impairment to health through being deprived of his dental armature.

As a rule I give the mouth about six weeks after the extraction of the teeth, at the same time advising the patient to gargle the mouth five or six times a day with a strong solution of tannin.

If the patient cannot remain so long without his teeth, I advise him to have a temporary set, which is inserted a few days after the operation to be worn until the mouth is in a fit condition for the permanent case.

This procedure possesses many advantages, in fact it puts the mouth into training. as it were, for the future set. The presence of the case is not noticed so much when it is inserted immediately after the removal of the natural organs; again the patient does not expect so much from them, and

will afterwards more fully appreciate the artistic and better fitting case that is in store for him.

Now, while one is preparing a patient's mouth for teeth, notice must be taken of the general expression of the face and of any peculiarity in the position of the natural teeth and their size.

It is a good plan if one has to extract a front tooth, to save it for reference as to size and colour,and for the latter purpose it should be kept in water.

One must note the colour of the teeth, for it would mar the effect of the best piece of work, if a brownish tooth were used when it ought to be a gray or blue. Nor must we make the mistake of placing in the mouths of elderly people the light shades incidental to youth. I would mention in choosing teeth that it is preferable for them to be slightly darker than lighter in colour ; they do not look so conspicuous. Artificial teeth always appear darker in the hand than they do in the mouth.

One must also notice the closure of the jaws, what is commonly called the "bite," and thus form an opinion as to the most suitable material for the case.

It is as well in all cases not to give an opinion hurriedly, one may have occasion to alter it when the models are taken and examined ; when in doubt one may say that the case requires a little consideration before finally deciding, and one must be guided by the models and the articulation, before arriving at a definite conclusion.

The following are some of the points to be considered.

The utility of the teeth to be preserved to aid in the retention of the case. The position of decayed teeth and healthy roots that may be crowned, forming attachments for clasps the same as the natural ones,

In a case where the six front upper teeth are in position close together, and no others posterior to them on either side, a difficulty will sometimes arise in supporting the artificial denture, especially if the patient insists on having a narrow plate, at the same time objecting to the clasps showing somewhat in front of canines.

If these two objections cannot be overcome, the dentist will have to safeguard himself if the patient has a lower case as well, by attaching swivels to the case to carry springs, failing that, he runs the risk of the case not answering.

The same difficulty is also apparent in lower cases where the six front teeth are short, the objections on the patient's part being the same as in the case of the upper jaw.

In the lower, one can of course load the case, but even then the patient may complain of the weight tiring the jaw.

The patient also, if it is possible, soon acquires the bad habit of moving the case about with the tongue, and comes back discontented.

These difficulties are mentioned more especially to guide the young dentist in discriminating between different modes of procedure, the necessities that each case demands, and which should be conveyed to the patient's mind at the time of undertaking the case.

Another example may be found in a case in which the size of the plate creates nausea and the reduction of the same means most probably destruction of its power of suction.

It is also of considerable importance to the dentist both pecuniarily and mentally as to whether he should undertake the responsibility of making suction work for doubtful cases; if he does, he should be able to command a much higher fee, for not only has he to make a more perfect denture in every respect, but he has also to assume the responsibility of the

wearer giving that amount of patience and encouragement, so to speak, to the case that will ultimately lead to his getting thoroughly accustomed to it, for more often than not the dentist's real troubles commence only after the completion of the cases, for he then has the much harder task of encouraging his patient, failing which his reputation is likely to suffer.

Therefore to avoid a few of the pitfalls into which the unwary beginner may be innocently led, in his efforts to secure the comfort of those committed to his care, it is as well when any doubt exists, owing either to the condition of the mouth or the inability of the patient to exercise the necessary amount of patience, to mount a set of swivels on the case.

If the patient can get along without springs so much the better, the swivels can be removed, on the contrary if they are required, springs may be attached and the trouble ceases.

As a rule the retention and steadying of the lower denture is the principal trouble to overcome, and unless that case be worn of a proper size, it will not remain stationary or be comfortable.

Another example of showing the value of taking precaution will be found in the following case.

Miss W. had a very short upper lip and showed all her front teeth as well as a considerable amount of gum. There was not sufficient depth for gum sections and the presence of vulcanite would have been objectionable, so the front artificial teeth had to be fitted on the gum. No work looks better than this, provided the teeth fit with a slight pressure on the natural gum, making them appear as if springing from it. This effect can be brought about by slightly scraping the plaster model when the teeth are being fitted.

Now although looking so natural, the break in the contour

of the gum destroying as it does, the cup-shape of the piece, in the majority of cases, has the effect of impairing its proper adhesion to the roof of the mouth.

Had I not taken the trouble to fix swivels, I should have had to remake the case and incur fresh trouble and expense.

Now as these precautions are found necessary when using a plastic material like rubber vulcanized on the original model of the mouth, it does not require a great effort of the imagination to understand that they are still more necessary when either gold or other plate has to be used.

A trial of patience will be saved by mentioning to the patient before commencing the case, that a doubt exists, and extra precautions must be taken with his or her case.

When a patient has been furnished with a denture, it should be brought home to him that there are certain hygienic principles necessary for him to observe, not only as to the desirability of keeping the case clean and wholesome, but also to assist materially in preserving the remaining natural teeth.

The patient should be instructed to remove the case at night, placing it in a tumbler of water with a small piece of ordinary common washing soda, this will dissolve all secretions from the surface, and when the further rubbing of the case with a tooth brush and soap takes place in the morning, the denture can be made absolutely clean.

The danger in wearing artificial teeth consists in the bringing of the thickened secretions of the oral cavity, and particles of decomposing food into intimate contact with the remaining natural teeth, and it is only by absolute cleanliness in the manner mentioned, that it is possible to avoid it, for no matter how much the case is brushed in the ordinary way, one has only to place it in a basin and pour boiling water

on it to see at once that the surface is still covered with a tenaceous white deposit.

The selection of roots for crowning, to form supports for artificial teeth requires the dentist's soundest judgment and discrimination.

Only those that are firm and free from disease should be saved, and they should be brought into the healthiest possible condition to prevent the occurrence of disease in the future.

Before making the case the roots should be tested for a short time to demonstrate their fitness and reliability for the purpose intended.

By testing, I mean that they should be trimmed again to the required shape, the canals should be cleaned out, and made perfectly antiseptic, and sealed up thoroughly. If they remain in a perfectly quiet condition, in a week one may venture to the crowning process.

The most important object one has in view in the conservation of roots is to enable one to reduce the denture to its smallest dimensions so as not to fill up the mouth—more than is absolutely necessary. One should not however, by such reduction take away the support it ought to afford to the teeth to enable mastication to be performed in an efficient manner.

On examining the teeth in a well formed mouth, one finds that each individual tooth comes into close antagonism with its opponents, and that the necessary amount of pressure to insure perfect mastication can be given and borne at any part of that double row of teeth.

To resist the real strain they are subjected to, without injury, one finds they are fixed in bony sockets lined with the alveolar dental periosteum; this, and the peculiar form of the sockets act the part of buffers and resist and break the shock

of the forcible closure of the teeth, during the process of mastication. The result is that [each tooth having such support can perform its allotted task in an efficient manner.

In ordinary dental plates the strain of mastication is borne by the denture resting on the alveolar ridges and gums, covering them and forming a bearing surface, and one finds that a plate so made allows pressure to take place on every part of the arch the same as with one's own natural teeth.

In finer bridge work, illustrated by many examples in Dr. Evans's book, the pressure of mastication must be borne by the unfortunate teeth that form the supports, and it would be most interesting to know how many of the cases which one must presume were placed in the mouths of patients, survived a twelvemonth's wear.

In four-fifths of the cases represented in that work, the conditions were such that a narrow gold plate could have been easily adapted, one that could be removed and thoroughly cleaned and give satisfactory results if the pressure of mastication was applied to any portion of the work. And if the teeth or roots to form its supports, were treated in the same manner as for bridgework, that is by crowning where necessary, one could put the patient in the possession of a masticating apparatus that would admit of no doubt as to its efficiency and durability.

Some Practical Hints on Taking the Bite, etc.

Six essentials are necessary for the satisfactory fitting of Artificial Teeth. They are:—

1.—Good Impressions.

2.—Correct Bite.

3.—Accurate articulation of Models.

4.—Selection of suitable Teeth.

5.—Proper alignment.

6.—Perfect occlusion with allowance for bedding.

1.—Good Impressions.

Material to be employed.—It is not intended here to eulogise any particular impression composition. Many kinds are on the market and each maker claims his to be the best. The most suitable can best be found by actual experiment. It must not be sticky when hot, nor flakey when cooling; must not set too quickly nor too slowly, and it should not be highly scented. In some instances it will be found advisable to first take a "slack" impression with composition, then cover it with a cream of plaster of Paris tinted with rouge. Re-insert in the mouth and keep firmly in position until set.

Taking the Impression.

Put the impression composition in a basin and pour hot water over it, let stand a few minutes, then take out a sufficient quantity, dry it on a towel and knead it in the hand until it is of an even temperature throughout. Warm the tray over the bunsen flame and press the composition into it, have a smooth even surface and do not over fill the tray.

If the gums are edentulous, just pass the surface of the composition over the bunsen flame and proceed to take the impression. If teeth are standing apply a very thin coating of vaseline to the surface of the composition to prevent its sticking to the teeth. If there are cavities in any of the teeth likely to drag the impression, fill them with moist cotton wool before taking the impression.

In upper cases with very high palates it is a good plan to make an air channel with the edge of a knife from the centre to the back of the impression composition; this prevents an air-lock when the composition is pressed up into the deep recess.

Note particularly :—With the patient's mouth wide open, firmly press the composition home, then keep it there **without further pressure** until it sets. Some operators make the mistake of applying pressure during the whole of the time that the composition is setting; this keep it on the move and results in a blurred instead of a sharp impression.

While removing the impression from the mouth, instruct the patient to "keep open": many impressions are distorted by the muscular action of half-closed lips. Having removed it from the mouth, run cold water over it before putting it down, or hang it on a hook

by the handle of the tray. Don't let the semi-cold material be touched by anything.

Casting the Model.

Let your plaster of Paris be of fine quality recently purchased and not kept exposed to the air.

Put some water in a basin, add a sufficient quantity of plaster, let stand a couple of minutes, pour off the superfluous water, then mix thoroughly to a smooth cream, shake some of it down into the deepest parts of the impression, then fill up level. Put the rest of the mixed plaster in a little heap on the bench and press the inverted impression tray with its mass of plaster down on to it. Trim around before too hard. When set, immerse the cast in boiling water until the impression composition is sufficently soft, then gently remove it from the plaster. Trim the model; let cool, then dust it over with powdered French Chalk.

N.B.—In casting impressions taken with Plaster of Paris, it is necessary to apply some separating medium such as soap solution or olive oil to the surface of the impression before casting. The tinted plaster is then easily removed from the white cast.

Mark the centre of the ridge at the back ends of upper and lower models.

2.—Correct Bite.

Never try to take the bite with impression composition. Such bites are seldom satisfactory. Use wax.

For part sets, if there are back occluding teeth on both sides of the mouth the bite may be taken with a roll of softened wax immediately after, or **before**, the impression is taken.

If there are not occluding back teeth on both sides of the mouth, it will be necessary for your patient to call again to have the bite taken, after models have been cast. Wax blocks, both upper and lower, if space permits, should then be prepared.

To make the blocks.—Soften half a sheet of wax or a base plate, by passing it backwards and forwards through the bunsen flame; press it on to the model and trim off excess with a hot wax knife. Now take another half sheet of wax, soften it in a similar manner and fold it up to make a solid block. Bend the block to follow the gum line and stick it on to the wax already on the model, taking care to keep it central with the gum ridge. Finish it off with a flat even surface, and sufficiently thick to make up for gum-shrinkage that has taken place.

The blocks should have their surfaces softened by criss-cross cuts with a hot wax-knife, then put into the mouth. Patient should be instructed to " close the mouth gently," then to "gradually tighten, keeping the jaws in the same position."

Never tell the patient to bite. In the act of biting most people protrude the lower jaw so as to bring the front teeth edge to edge. This widens the space between the jaws at the back, and teeth set up to that position gag the bite. The position required for correct articulation is that with the mouth at rest. Therefore, don't tell your patient to bite. Watch his mouth while he is talking to you; you will then get a fair idea of the normal relation of one jaw to the other.

While the bite blocks are in the mouth, ask the patient to close the lips and observe whether the mouth appears normal or too full. If the lips are compressed, the bite is too close

and the blocks will need building up with extra wax. If the lips scarcely meet or appear stretched, the bite is too open and the wax blocks will require thinning down.

Note carefully the position of the jaws and if, in spite of every care, the patient persists in protruding the lower jaw, it is a good plan to tell him to swallow, then close, or to close the mouth so as to make the back teeth meet, even when they are not there, or tell him to turn the tip of his tongue up to the back edge of the upper plate.

Before removing the blocks from the mouth, the correct centre of the upper lip should be marked by a vertical line in the wax. This is done by the operator while standing directly in front of his patient, otherwise the mark in the wax will not be central.

Diagonal marks crossing upper and lower blocks should also be made in the wax at the sides of the mouth, so that if the blocks become separated they can be put together accurately.

It is a good plan also to make a horizontal cut in the wax to show the position of the lower border of the upper lip. Indicate the position by caliper marks on the upper model.

If you are still in doubt about the bite, have the teeth set up in wax and tried in before the cases are completed. In full-set cases it is a good plan to have all the lowers set up, but only the front six uppers, the backs being substituted by wax blocks. The lower backs then bite into the softened upper wax and enable one to get the correct articulation.

3.—Accurate articulation of Models.

Having obtained the correct bite, the next step is to see the models properly articulated.

To this end the upper and lower blocks should be stuck together and each stuck to its own model by means of a hot wax knife. The vertical centre mark should be extended upwards on to the upper model and downwards on to the lower model. Plaster is then used to attach the models to the articulator and the set-screw is tightened by its lock-nut before removing the wax from the models.

When it is removed, if the bite has been correctly taken, the upper and lower gum ridges viewed sideways should be approximately parallel. If they diverge forward the bite is too open; if backwards, it is too close. Adjust the set-screw accordingly.

4.—Selection of suitable Teeth.

The length of the teeth chosen should allow the gap being filled with a minimum of vulcanite. No one likes to see artificial gum, therefore see that the teeth are long enough to avoid the artificial gum coming below the line of the natural gum in the upper or above the line of the natural gum in the lower.

The size of the arch should indicate the width of the teeth required, and the colour should be chosen to match already existing teeth or to suit the age and complexion of the patient. The bicuspids and molars should be long enough to allow the gum line to be kept level with the necks of the canines.

Relative width of upper and lower fronts:—The points of the upper canines should fall between the lower bicuspids and canines to enable the upper and lower backs to dovetail properly.

5.—Proper Alignment.

When setting up the teeth, as little wax as possible should be on the models so as not to hide the gum ridges. If the centre of the

ridge be marked on or beyond the condyles, the ridge can very easily be defined.

6.—Perfect Occlusion with Allowance for bedding.

The lowers should be set up first, commencing with the centrals and working backwards, keeping the backs well up so as to avoid making the upper case unnecessarily heavy. A watchful eye must be kept on the vertical centre-mark, and the plane of the tips of the teeth kept perpendicular to it. Having set up the lower, commence the upper in the same way with centrals. Set the tips of the upper 6 fronts just down over the tips of the lowers **but not touching them,** and set the backs to articulate closely with the lower backs. The little interval left between the upper and lower fronts allows for the bedding of the dentures into the gums when pressure of mastication is put on the backs. It will be found, after the dentures have been worn a few weeks, that the interval between the upper and lower front tips gradually disappears and that a firm even bite all round ensues. Unless the said interval be left at the time of setting up, the bedding of the dentures leaves a gap between the upper and lower backs and puts a strain on the upper fronts, causing them to get chipped or become loose in the vulcanite.

For the same reason in part sets, where the patient has upper and lower natural front teeth in contact, it will be necessary to gag the artificial backs a little to allow for bedding. Otherwise, as pressure is exerted on them in the act of masticating they will sink into the gums and a space will develop between the upper and lower backs. Then the extra pressure put upon the natural fronts will cause them to move forward and leave a gap between the plate and the front teeth. Think of the future as well as the present.

E. Davies & Son, Printers, Paradise Place, Cardiff.

VULCANITE WORK.

VULCANITE, or hard rubber, is a combination of caoutchouc, sulphur, and a colouring matter such as vermilion, to disguise and render more agreeable the colour of the native gum.

The remarkable effect of sulphur in combination with India rubber was discovered by Charles Goodyear, about the year 1840. In certain proportions and at certain temperatures the sulphur does not impair the flexibility of the native gum, but preserves it at low temperatures.

Hard rubber was afterwards discovered, and its use was devoted to the manufacturing of combs, buttons, etc., several years before its application to dental purposes. This was first attempted in 1853. It seems to have made but slow progress for it could not be said to be in general use until about 1868, when its claims to recognition became so strong that it completely superseded as a base plate, those formerly made of the tusks of the Hippopotamus, Walrus, and Wild Boar. It has, no doubt, been of immense service to the general public, enabling thousands to realise the benefits of the art, where formerly it was restricted to the few.

The introduction of this substance, and the comparative ease with which it could be manipulated, acted in another respect somewhat disastrously for the dental profession, introducing into their midst hundreds of unqualified, I should rather say untrained men, who but for this material would never have been able to earn a living by calling themselves dentists. This incursion of uneducated men into the profession, has also had a great effect on the quality of the work, for men who are content to work for a mere living wage, are not likely to develop æsthetic tastes, or raise their patients to a full appreciation of true art.

Hard rubber has now stood the best of all tests, viz., that of time, and the different makers have vied with each other in perfecting it both in colour and strength. It still maintains its position as the one material whereby an accurate and perfect representation of the dental arches can be obtained, and it is also the sole plastic material that remains unaffected by the secretions of the oral cavity, being at the same time strong, durable and clean.

Having then such a reliable material at our command, it should naturally prompt us as dentists to display our utmost skill, and to raise our productions to the highest possible level.

In order to ensure perfect accuracy of fit in a hard rubber plate, it is absolutely necessary that it be vulcanized on the original model of the mouth, for if we depart from the original by taking another cast from it to vulcanize on, we are more likely to get an imperfect fit, instead of a perfect one.

As any increase in the thickness of a vulcanite, or in fact any plate, is detrimental to clearness of articulation, it becomes a matter of extreme importance to reduce the thick-

ness so as to fill up the mouth as little as possible, but at the same time not to make any decrease in the strength of the plate.

Having that object in view, one is naturally led to consider how such a combination as strength and lightness can be brought about.

One finds by experience that a plate of an even thickness combines these two essentials, but to produce a thin vulcanite plate, copying the markings of the palate, and to preserve it from damage during the subsequent filing up and polishing, it is necessary to bring the surface of the palate out after it has undergone the process of vulcanization, with such a finish, that it will require no further filing or scraping, but only a slight rubbing with a brush at the lathe to complete it.

Vulcanizing the rubber consists in subjecting it to a temperature of 315 Fahr. for one hour and a quarter, in a suitable gun metal or copper boiler called a vulcanizer, especially prepared for this purpose. This treatment hardens the rubber, and allows of its being filed up like a piece of bone or ivory, and also of acquiring a high polish.

It will be my object in the following pages to explain how hard rubber plates can be produced of an even thickness, and yet have the elements of thinness, lightness, and strength.

Having the plaster models of the mouth articulated in a bite frame, we may adopt one of the following methods for making the matrix plate to mount the teeth on.

1st. A wax plate of the required thickness accurately moulded to the model.

2nd. A thick tin, lead, or meter metal, plate struck or swaged upon a zinc cast.

3rd. A sheet or sheets of meter metal blown into shape by means of the steam swager.

4th. A rubber plate fastened to the model by a solution of rubber in chloroform.

5th. A cooked vulcanite plate.

6th. A plate produced by means of a section separating a flask the required width.

The material used for the first named plate is a combination of bees wax and pure paraffin, in the proportion of two of the former to one of the latter, with a little carmine added to give it a pink colour. The carmine is first incorporated with a small portion of the melted wax so as to ensure its being intimately blended, after which it should be poured into the rest of the wax and paraffin and well stirred. The mixture should then be poured into a damp plaster mould, or on to a greased plate, to form it into thin cakes. It may then be re-softened in warm water and rolled into sheets of the proper thickness with a wet glass roller on a glass slab.

The plate is made by softening a sheet of the wax, by passing it to and fro over the flame of a spirit lamp, or Bunsen burner, taking care that the surface of the wax is not melted. One must now cut from the sheet with a pen-knife or pair of scissors, a piece sufficiently large for the case, which is then softened and accurately moulded to the palate, and alveolar ridges of model, beginning at the deep portion of palate first.

It is very essential that the wax be kept of an even thickness and the surface perfectly clean, smooth and free from blemish during the subsequent mounting of the teeth. By holding the wax plate against the light, one can readily

perceive if any thinning has taken place, the light penetrating more through the thin part.

When the wax plate has been moulded and trimmed to the proper size, it should be tacked to the model by means of a warm instrument passed round the edges, thus melting them and thereby fixing. This prevents the slipping of the wax plate, keeping it secure while the teeth are being mounted. A modification of this method of making a wax plate, and which in some cases is very valuable, is by first fitting the teeth to the alveolar ridge, tacking them in place with wax, then adding wax to build up the front gum after which a piece of sheet wax of suitable size and thickness is moulded to the palate. The wax plate therefore, in this case has not to suffer the wear and tear of adjusting the teeth.

No. 2 matrix plate possesses certain valuable qualities not found in the former. In the first place it can be made, if necessary, of extreme thinness ; secondly, there is no danger of injuring its surface during the mounting of teeth ; thirdly, it has the still further advantage of enabling one to try it in the mouth after the teeth are mounted without the risk of its being bent out of shape or softened by the warmth of the oral cavity.

To produce this matrix plate one must take the plaster model and cast it in sand and obtain a zinc model, or die, and a lead counter, the same as for swaging up a gold plate. Having moulded a piece of lead foil to the zinc model,(on no account should the plaster model be used for this purpose), a corresponding piece of metal is cut out from a sheet of tin, lead, or meter metal, preferably the latter, because it is much stronger. This should be roughly adapted to the

zinc model with a bone mallet, and then adjusted in the lead counter. The zinc model being placed in position, it should receive two or three blows with a heavy hammer or weight, and if satisfactory, the plate may be trimmed up according to the size required, and after seeing that it perfectly fits, the model can be used for mounting the teeth on. These having been mounted and fitted to the bite, the next operation is to obtain an impression in composition of the palate and backs of the teeth.

This can easily be done by softening and flattening out a small piece of composition, then lubricate the fingers with a little vaseline, and while the composition is still soft, press it so as to take an accurate impression, after dusting with French chalk, of the part that is required to be brought out polished.

Plaster of Paris can now be poured into this impression and a model made suitable for casting in sand the same as for the matrix plate.

A thin piece of tin or meter metal should now be struck or swaged up, and when completed is known as the polishing plate.

The matrix plate, therefore, of whatever substance it may be, represents the thickness of the contemplated rubber plate, and the polishing plate should fit accurately to it, and should cover the whole of the palate and slightly overlap the crowns of the molars and bicuspids. When adjusted, it should be fixed in position by slightly warming the edges of the plate at the back of the molars with a hot wax modeller—this fastens it to the wax, and is to prevent it slipping or rising from its place when the case is being inserted in the flask.

In order to make the next process clear for obtaining a matrix and polishing plate it will be advisable first of all to

give a description of an apparatus invented by my colleague Mr. W. R. Humby for this purpose and called the Steam Swager.

THE STEAM SWAGER.

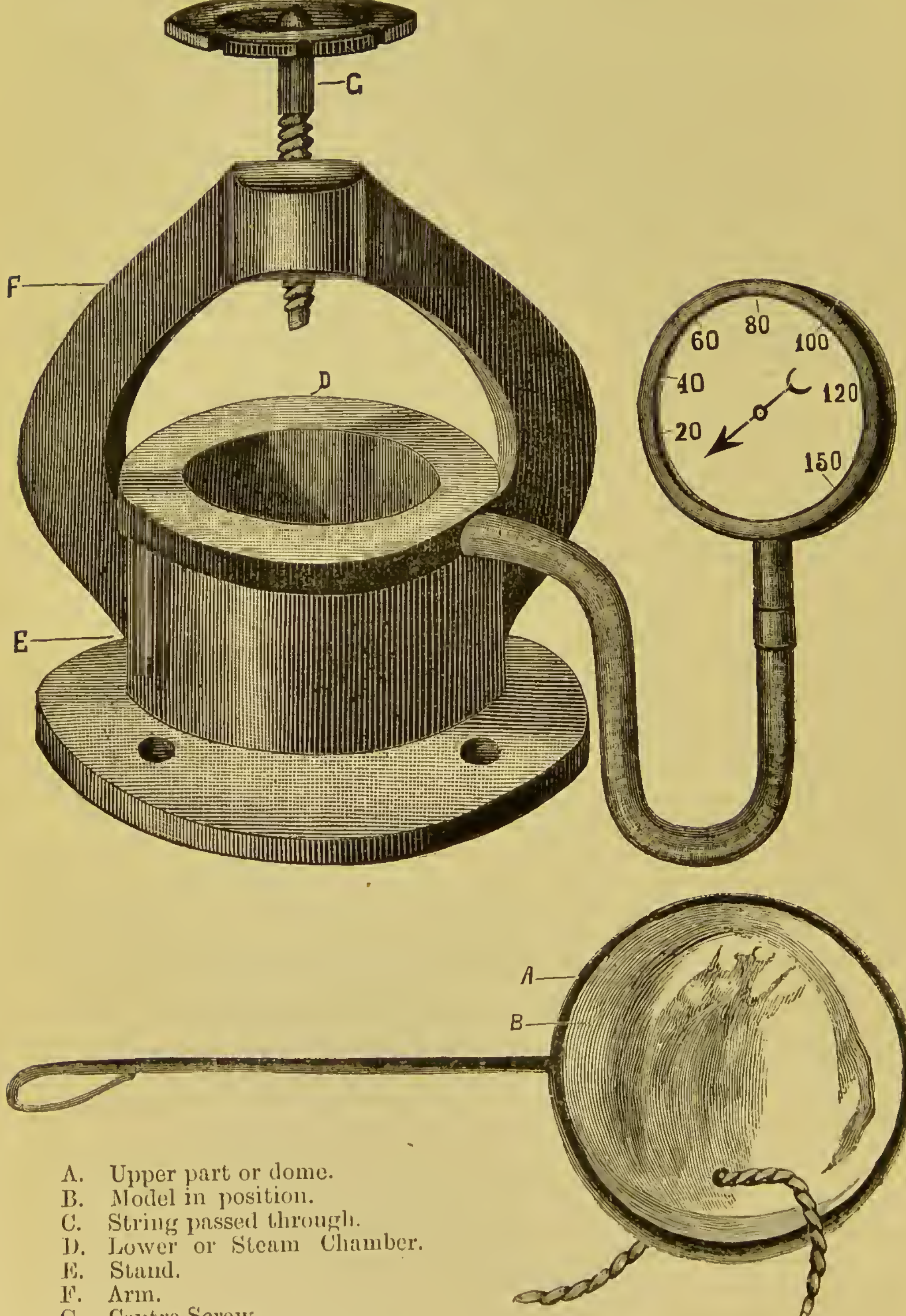
The Steam Swager is a hollow gun-metal chamber, the lower part of which will contain water, the upper dome-shaped portion being intended for the reception of a plaster representation of the shape of a plate, obtained by means of an A 1 or other composition impression.

When in action the upper part is shut off from the lower by a sheet of meter metal, which forms a diaphragm between the two. There is a hole drilled through the side of the dome near its upper border. This hole is of the greatest importance in allowing air, and also the steam that is generated from the damp plaster to escape, instead of being compressed between the meter metal plate (as it is being forced upwards), and the top of the dome or the surface of a model if present.

This hole should be on a higher level than the deepest portion of the model, and should have a groove leading to it from that part. Great care should be taken to ascertain that there is a free communication from the surface of the model with the external air.

Should this precaution be omitted and no exit allowed for compressed air, etc., when the steam pressure is removed the plate instead of being on the surface of the model will be inverted, or in other words turned inside out by the sudden expansion and consequent reversal of the pressure, being then, of course, useless.

Having obtained an impression in composition of the model or surface we require to polish, we mix up a small quantity of plaster of Paris, pouring some into the impression



A. Upper part or dome.
B. Model in position.
C. String passed through.
D. Lower or Steam Chamber.
E. Stand.
F. Arm.
G. Centre Screw.

Fig. 1.—THE STEAM SWAGER.

and some into the dome of the swager, having previously taken the precaution to place a piece of thick twine through the hole in the upper part. We now turn the impression over on the soft plaster in the dome just the same as if casting a model on the bench, and when the plaster has set, hot water is poured on to the composition in order to soften and remove it, after which the twine is withdrawn through the plaster.

We now have a plaster cast of the plate required with the requisite perforation for communication with the external air, and must trim off any sharp edges from our cast in order to prevent tearing of the metal before it is forced quite home on the model.

The lower chamber of the swager is half filled with water, and a suitable piece of meter metal cut out, also a corresponding piece of brown paper to act as a washer and form an air-tight joint to prevent escape of steam during the swaging process.

The sheet of meter metal and washer having been placed in position, the dome is fixed on the lower part by means of the adjustable arm, and screwed firmly into its place.

Heat is now applied by means of a Bunsen burner, and as the pressure of steam increases, so the meter metal diaphragm is forced upwards and made to copy the surface of the model or cast in the dome, steam, from the damp plaster, and air escaping through the perforation in top of the dome until the process is completed.

The pressure required for a polishing plate is about sixty pounds, that for a matrix plate about eighty, indicated by the gauge fixed to the lower or steam chamber.

When this point is reached, the gas should be turned out, and when the pressure has sunk to about thirty pounds, the

screw that holds the dome in place may be gently loosened, and the remainder of steam allowed to escape.

The dome is now removed, and the plate withdrawn and trimmed to size with a pair of strong scissors ; it is then ready if a matrix plate, to fix to the model as the one last named, to mount the teeth on. The matrix plate realizes in ts results the very perfection of what is known as a contour plate. This method of blowing up, according to thickness of the matrix plate required, of one, two, or three sheets of meter metal, on to a duplicate model cast in the swager, the model being obtained by means of an impression taken from the original in A 1 or other composition, is one to which I attach the greatest importance.

By using the Swager for this purpose the trouble and time lost in obtaining a zinc die and lead counter is saved, and the result obtained is so superior to that done by stamping up in metal dies that the two operations will not admit of any comparison.

In taking the impression of the original plaster model it is first of all necessary to dust it with French chalk or Lycopodium, then soften a portion of composition, and after kneading to free it from lumps, press it into the palate and then over the alveolar borders as far as required. If the fingers are lubricated with a little vaseline, the composition will not adhere to them, and when hard the impression is removed.

If there are natural teeth standing on the model, it will be sufficient to take an impression of as much of the model as we intend to cover with the rubber plate, and not bringing it up the teeth, in this way it can be readily removed from the model without injury.

On the other hand should the model, through some under-

cut, present a difficulty in the way of obtaining an impression in one piece, it can be overcome by taking it in sections. Thus the impression of the palate can be taken first, removed when hard, and the edge bevelled off—then replaced on the model, and after being dusted with French chalk, soft composition to take the undercut is pressed into its place.

The two pieces of composition can now be readily removed and fixed together with hard wax to cast in the dome of swager ; which is done in a similar manner to that previously described. The meter metal plate or plates are now adjusted to the lower part and the swager closed.

The pressure required for this part of the process is about eighty, or if more than one thickness of metal is used, a hundred lbs., which will be sufficient in most cases to produce a result such as could only be obtained by electrotyping, the plate not buckling nor in any way bearing the evidences incidental to stamping up in the ordinary way.

By means of a matrix and polishing plate produced in this way by the steam swager, one can obtain a perfect reproduction of the roof of the mouth, and the vulcanite plate made to represent a setting for the teeth copies the surface of the gums, both on its inferior as well as superior aspect, and the rugæ are accurately reproduced.

The advantages of such a plate are obvious ; it takes up the smallest amount of room in the mouth, at the same time presenting to the tongue a surface such as it has been accustomed to.

Both articulation and mastication are thereby improved, and the patient becomes used to the case in much less time than he otherwise would.

No. 4 on our list is a matrix plate made by coating the

plaster model with a sheet of rubber. To effect this it is necessary first of all to dry the plaster model, and while still warm to paint over its surface a solution of rubber in chloroform ; the warmth of the plaster causes a rapid evaporation of the chloroform, leaving a coating of rubber on the model; this should not extend further than the plate is required to cover, because it renders the trimming up of the soft rubber a difficult operation.

A pattern having been previously obtained, a piece of sheet rubber of the required size is now cut out, and after warming over a spirit lamp or on a hot plate, is pressed first of all into the concavity of the palate. The object of pressing the rubber into the deep portion of the palate first, will be apparent at once when I mention that wherever the rubber plate comes in contact with the film of rubber on the model, there it firmly adheres ; for example, were it to attach itself to the alveolar borders first, it would be found impossible to force it into the palate afterwards.

When the rubber plate has been carefully worked between and around the teeth, and any excess trimmed off with a warm knife, it is ready to mount the teeth on.

The advantages of a rubber plate such as I have described are :—

1st. That the palate requires no further packing.

2nd. That the plate is of an even thickness and copies to some extent the roof of the mouth, and

3rd. That the teeth may be, if desired, fitted and fixed to the rubber plate by means of small pieces of soft rubber, instead of attaching them to the plate with wax in the ordinary way.

If the rubber is kept warm and small pieces are used the

packing of a case under these conditions is not a difficult undertaking.

Thus the case can be packed on the model, and when the surface of the rubber has been smoothed by rubbing it with a pledget of wool or a stiff camel-hair pencil moistened with chloroform, and a polishing plate fixed to it, nothing more is required than to immerse it in plaster in a flask and it is ready for the vulcanizer. If it is not desired to do all the packing on the model, the teeth may be fixed to the rubber plate with wax, and then after inserting the case in the flask in the ordinary manner and washing out the wax with boiling water, the packing may be completed.

5.—A cooked vulcanite plate. For the description of this method of obtaining a matrix plate, I am indebted to my friend, Mr. W. R. Humby, who claims the following advantages :—

1st. In having a rigid vulcanite plate on which to mount the composition to obtain the bite or articulation.

2nd. To test the correctness of the model, and if necessary, when the teeth are mounted and waxed up, to again try in the mouth to ascertain their position and expression.

3rd. The trial denture approximates very closely to the perfect, and so gives one a better idea of the adaptibility of the case to the patients' requirements.

This method can only be applied to edentulous cases, and the making of the preliminary plate involves a little extra labour, but I am assured that for practical and perfect results it well repays for any extra trouble.

The principle of working is the following :—

After taking the impression of the mouth and pouring plaster into it,the resulting model is partly dried, and while still

warm is painted over with a solution of chloro-rubber, corresponding to the size of the plate required; a sheet of rubber is then adapted to the model and trimmed to the required size.

The model coated with rubber is now to be embedded in plaster in a flask, and when the plaster has set it should be placed in the boiler to be vulcanized. On removal from the vulcanizer, the flask should be placed in cold water until it is, itself, perfectly cold. The rubber plate is now to be removed from the flask, and all traces of adherent plaster washed away.

The plate should be nicely filed up and the edges made perfectly smooth.

Some composition is next softened and adjusted to the plate, along its alveolar border, in order to try in the mouth and to obtain the correct bite.

After obtaining the bite, plaster of Paris is to be poured on to the superior palatal aspect of rubber plate, and a preliminary model formed as if pouring plaster into an impression; before doing so, however, all undercuts should be filled in with wax, or other soft, easily removable material, and the inside of palate either soaped or rubbed over with vaseline, so as to ensure its easy removal from the model for the purpose of trying in the mouth, if found necessary.

If the case is not to be tried in the mouth then the precaution of waxing up undercuts and the making of a preliminary model may be omitted and greater care should be observed in seeing that the inside of palate is free from particles of plaster or any imperfections before pouring in fresh plaster to form, what is to be, the permanent model for vulcanizng on.

Let us now presume that the waxed up case has been tried in the mouth and the teeth arranged satisfactorily.

The next operation is to take a flask and pour some plaster into the lower part, (that is the part from which the guides spring) and also, after oiling, into the superior palatal aspect of the rubber plate which should then be turned over on to the plaster in the lower part of flask, thus forming the permanent model. The plaster when set should be trimmed to the edge of the vulcanite plate,and after dusting the palate of the case with French chalk, a piece of softened composition should be pressed into and adapted to it so as just to overlap the edges of molars and bicuspids and the backs of front teeth. This impression is cooled by dipping the case into cold water, and when removed is to be sunk in plaster in the steam swager and a polishing plate made, as previously described. After trimming the polishing plate to the proper size it should be fastened to the case in the flask, by touching it with a warm burnisher at the backs of teeth, and after soaping the plaster surface in the lower part, more plaster must be mixed and the upper part of flask filled in and the lid placed on.

When the plaster has had time to harden the flask should be heated to soften the wax, either by placing it on the top of a stove or Bunsen burner, or by putting it for five minutes in boiling water. This will facilitate the separation of the two halves of the flask and at the same time soften the wax sufficiently to allow of its parting from the vulcanite plate and to come away in the upper part of flask; the vulcanite plate will, of course, be on the model in the lower part.

To ensure the parting of the rubber plate from the model so as not to damage the latter should it present any undercuts, it should be held over a gas flame; the rubber will then soften, curl from the surface of model, and can then be readily removed. The wax in upper part has now to be washed

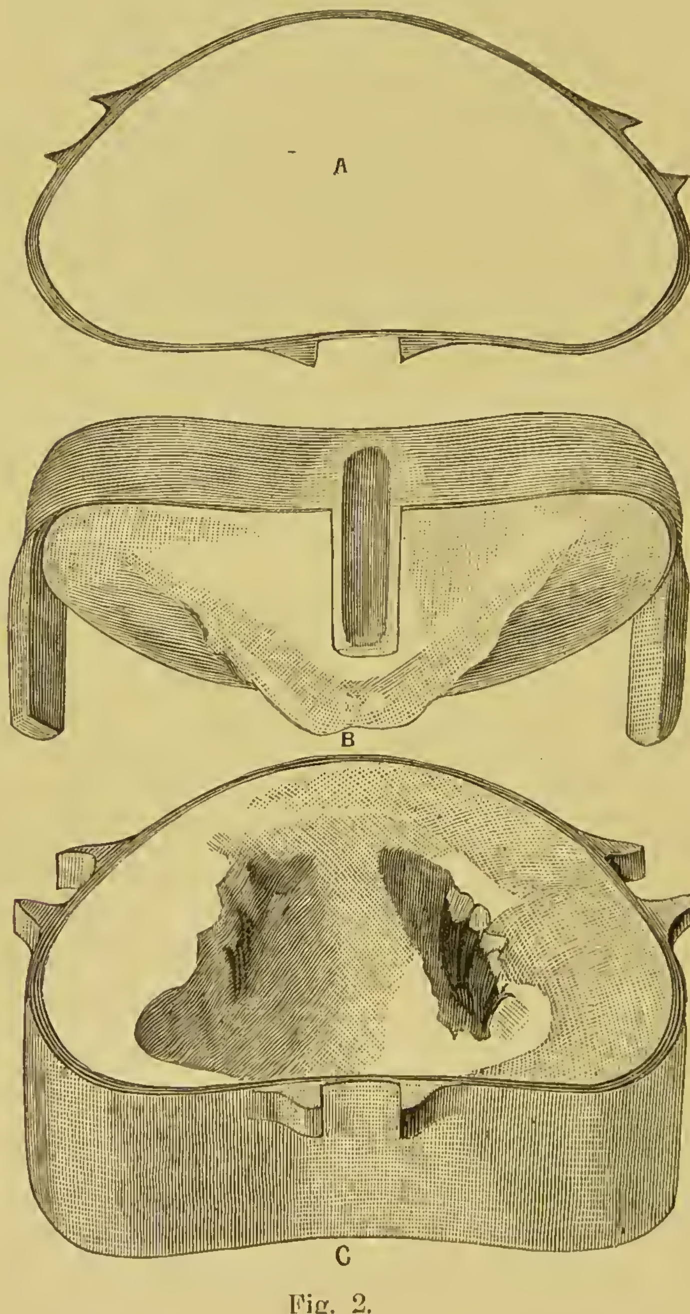


Fig. 2.

away with boiling water and the case packed with rubber in the ordinary manner.

Number six in our list is the production of a contour plate by means of inserting a thin section, (see Fig. 2), between the two halves of a flask when the case is being packed.

An ordinary flask is divisible into three pieces which may be called bottom, upper part, and lid. To convert this into a section contour flask, it is necessary to have another piece about 2-16th thick between the lower and upper portions,(seeFig.2A). In order to produce a vulcanite plate by means of this flask, it is necessary to leave the section out when the case is mounted in the flask, but when the case is packed with rubber, it is put in its proper position ; the rubber will then correspond in hickness to the sectional piece.

Now this will answer very well supposing we are only making a vulcanite plate, but in making a plate with teeth added, we should have the bite raised by the thickness of the section, unless precautions are taken. These precautions consist in so fixing the teeth in position, that they cannot rise, and thus the only thickness will take place in the palate.

To make this appear quite clear we will take an upper partial case, and mount the teeth, tacking them in their places, and waxing them up neatly, but not putting the wax plate over the palate.

When ready, the case is placed in the upper part of flask with the plaster covering the edges of the teeth. A polishing plate can now be made to this, or the surface may be painted with silicate of soda, before finally closing the flask.

It is then trimmed up, and when hard, the plaster and palate of model are soaped, so as to allow the polishing plate to come away. Some more plaster is now mixed and poured

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into the palate, and into the lower part of flask, and it is then squeezed to make the edges of the flask fit tightly together.

When the plaster has become hard, the flask should be either warmed on a stove, or placed for a few moments in boiling water; this will cause the two halves of flask to part readily. It will thus be seen that the teeth are fixed, and the only part that could be affected by a separation of the halves of the flask is the palate, and that only to the extent of the thickness of the section which will be placed in position when the case is packed and ready to boil out.

The only methods of producing a polished superior palatal surface (not lingual) that I know of, are the following:

The first consists in coating the model with gold foil just before closing the flask after packing the rubber. The second is to take a plaster impression of the mouth and by the aid of the steam swager, blow a meter metal plate into that; and the third process is to dry and coat the model with chloro-rubber, mould a rubber plate to it and vulcanize. Carefully clean and file up the rubber plate and utilize that to blow a meter metal plate into, taking the precaution to have the plate perforated at the deepest part, and to mount in plaster of Paris before removing from the swager, to prevent bending or damaging the thin metal plate.

With the first process we increase the size of model by the thickness of gold foil, with the second and third we produce a metallic plate of the exact size of impression, so that when plaster is poured into it, it may serve as the model.

Having in the preceding pages given a description of the various means adopted for producing vulcanite plates, I will now proceed to explain how the teeth are mounted on them.

Whenever there is gum in front or at the sides of a case

it is essential for strength that the teeth be hollowed out so as to allow of the thickness of rubber beneath them to be of sufficient strength to support the rubber in front, or at the sides, and thus lessen the risk of its being broken away.

To commence with, I will take as an illustration the models of a complete edentulous set, using the wax plate on which to mount the teeth. The plate, especially for an edentulous case, should be made as broad as possible, in the lower jaw bringing it well over the mylo-hyoid ridges posteriorly—this steadies the case and is of great assistance if springs are not contemplated.

Having moulded a sheet of wax to the lower model, to which it should be tacked with a warm instrument passed around the edges, we begin to mount the teeth after having first bent the pins in a suitable manner to retain their hold in the vulcanite. They should be flattened and bent at right angles to the tooth and where possible clubbed at the ends; care must also be taken to bend them downwards or upwards as the case may be, towards the gum margin, so that they do not shew through the rubber when the case is being filed up. This latter precaution is very commonly omitted, and such a mistake mars the beauty as well as the strength of the best piece of work.

Having placed the composition dummy piece on the upper model and fixed it there (Fig. 3.), we now commence to mount the lower teeth, beginning with the two lower centrals, the upper dummy case serving as our guide for projection, length, and centre of mouth.

Some degree of irregularity in the position of the front teeth should be attempted in order to make them more natural in appearance and to conceal their artificial character.

One central should be a little shorter than the other and both centrals slightly overlapped by the laterals ; this turn of the laterals brings the canines apparently into greater prominence, thereby giving a fuller and more pleasing expression to the lower lip.

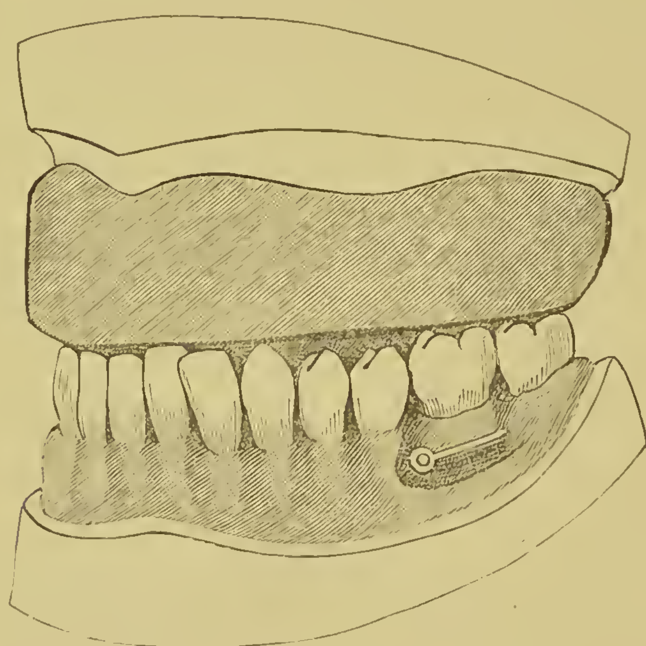

Fig. 3.

Of course care must be taken to avoid any pronounced " fierce" isolation of the teeth.

The points of lower canines may be bevelled on their labial aspect giving them a better edge for biting and also an appearance of being worn down. A part of the internal cusps of the first lower bicuspids is also ground off so that they do not present such an abrupt angle next the canines, which is not natural, and would only get in the way of,

and irritate, the tongue. The second bicuspids should be kept out a little further than the first, and placed more upright. The first molars still further out and the second molars in a line with the first.

If it is intended to put springs on a set, the arch must not be expanded in the molar region more than is absolutely necessary, as the springs would then come into too intimate contact with the cheeks and irritate them to such an extent that the case could not be worn.

It is therefore best in such cases to contract the arch slightly or else to use narrower teeth.

In smoothing and trimming up the wax, care must be taken to give as natural an appearance to the gum as possible, and where swivels are inserted, the buccal portion of gum extending from the second bicuspid backwards should be formed so as to afford support for the springs and prevent them from slipping down upon the mucous membrane.

Having mounted the lower teeth, the next business is to remove the composition dummy piece from the upper model.

The upper model must now be prepared by fixing a tin, lead, or india rubber disc to the centre of the palate to form a suction chamber, and by making within the circumference of the intended plate, with a steel point, a shallow groove to form a ridge or series of ridges on the finished case. (Fig. 4.)

I generally make two sets of grooves, one extending round the case, and the other extending from the tuberosities on each side and passing round the soft substance of the middle portion and sides of palate.

These grooves, or rather the ridges resulting, convert the whole case into one large suction chamber, and they help in a great measure to prevent the primary suction of a case from

failing, as a slight movement does not raise or tilt the case sufficiently to free these ridges from the depressions they make for themselves in the soft portion of the palate.

These grooves should not be cut too near the edges of the plate in case it is found necessary to reduce it, when the ridge would be cut away and its utility destroyed.

A line should likewise be made round the circumference of a suction chamber if the use of the latter is decided upon.

The suction chamber can be made either round, heart-shaped, or oval, in the latter case a small chamber may be formed on either side of the bony ridge in the centre of the palate.

Fig. 4.

The heart-shaped chamber besides its powers of suction is also to keep pressure off the centre of the palate when the ridge is more elevated than usual, and even in the event of not using a suction chamber, it is often found necessary to take the pressure off this ridge by placing a layer or two of tin-foil along it, extending to a quarter of an inch of its posterior border.

The upper model being prepared a sheet of wax is moulded, to it and trimmed up into form and size after which it is tacked to the model by a warm instrument as in the case of the lower.

Too much care cannot be taken in mounting teeth. Some cases are spoilt by the teeth being too long, others on the contrary are too short ; in the first case the patient looks all teeth and in the second the patient's friends ask her what has become of her teeth.

The upper dummy case or "bite" should guide us as to their length, and notice must be taken whether the patient has a long or short upper lip. Too much regularity is also to be avoided, for nothing looks worse to an artistic eye than an extreme regularity of artificial teeth, for we must recollect that our best efforts should be to conceal our art.

In some cases it may be necessary to grind the artificial teeth to conform to the shape of the natural teeth.

This is best done with teeth that are of one texture throughout, such as Ash's, and the glaze or surface comes out of the body by heat. Teeth such as these can be cut and polished, whereas a porous tooth, or one upon which the glaze is put afterwards, cannot be polished again after being ground.

We must also bear in mind that the more the teeth are kept on the alveolar ridge, and the more directly the pressure is brought to bear on them, the greater the suction, stability, and masticating power.

In fact, the greatest power of mastication is obtained from a case in which the teeth are placed to what is called an edge and edge bite, such as we see in the mouths of middle aged men, when the teeth are worn down somewhat by hard use.

If the teeth are placed prominently as they sometimes must

be, there is a pressure outwards and forwards, and a tilting from the back of mouth; in these cases the pressure of the bite should be greatest in the molar region. This will not prevent the front teeth from antagonising, for we find that in the natural bite the front teeth can be articulated, and yet the back teeth do not of necessity touch.

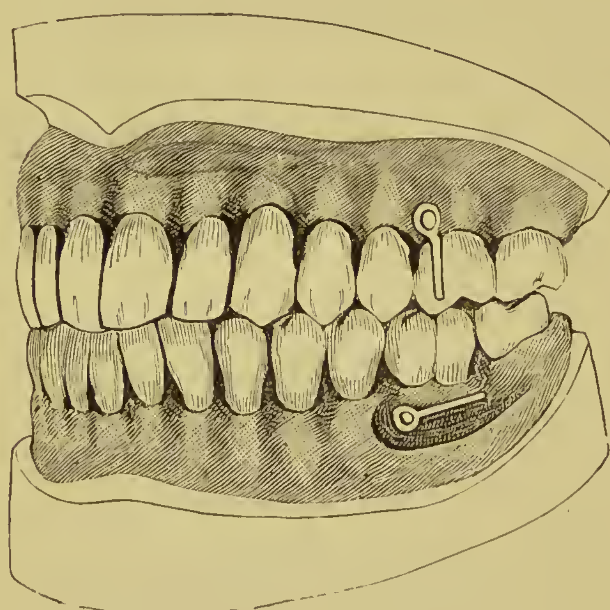

Fig. 5.

Beginning with the two central incisors, we must mount the teeth on the wax plate as nearly as possible in the situation on the alveolar ridge formerly occupied by the lost natural ones, and their cutting edges should overlap those of the lower incisors. (Fig. 5).

The next teeth to arrange are the laterals; these are not brought out quite so prominently at their necks. By arranging the points of these teeth so that they overlap to some

slight extent the central teeth, a very natural appearance is produced; they may also lean towards the front teeth, and look slightly shorter. The mesial angle of the tooth is much more pronounced than the distal, thus allowing one to give a distinctive character to the canine or next tooth to be mounted, which should be more prominent both at the root and point than the laterals.

The canine tooth, and the fulness over the root constituting the canine eminence, is instrumental in giving expression to the upper lip; great care is therefore necessary in arranging these teeth satisfactorily. They should cover the distal half of the lower canines, and the mesial half of the first bicuspid.

The first upper bicuspid is now placed in position next the canine, it is made slightly shorter than the canine, and should be placed somewhat less prominently than that tooth. It should articulate with the distal half of the first lower bicuspid, and the mesial half of the second, and the outer cusps must overlap those of the lower.

The second bicuspid should be placed somewhat further out than the last named, and is generally made somewhat shorter than the other, it should fill in the concavity between the second lower bicuspid and first molar. The first molar is now placed in position, and should be articulated with the lower, and describe, with the second molar, a more rounded arch than that formed the corresponding teeth in the lower, except where the case is intended for spiral springs, when the molars may articulate edge and edge in order that the springs may not come in the way of the cheeks. Having now mounted the teeth we must build up the representation of the gum, and fill in round the backs of teeth, this should

be done neatly, carefully removing any surplus wax, and bearing in mind that it will facilitate the finishing process if this part of the operation is done in an artistic manner.

The next operation is to take an impression of the palate and backs of the teeth; this can be done by softening a small, piece of composition, flattening it out to a suitable size, and, having previously dipped the case in cold water to prevent the softening of the wax, it is then moulded to the surface of the palate and the backs of the teeth, and dipped into cold water again, and finally removed.

This will give us an impression which we can either cast in plaster, and thence obtain a zinc model, from which to stamp up the polishing plate, or which we can use to place n the steam swager as previously described.

This polishing plate is now fixed to the wax palate and the case is then ready to insert in the flask.

Description of a Case in which the Front Teeth are Fitted on the Natural Gum.

The wax or other plate is first moulded to the model, cutting it away from the part where the artificial teeth have to come into contact with the front gum or the stumps of the natural teeth, if any be present.

In order to make the artificial teeth appear to spring or arise out of the gum in the mouth, like the natural teeth, it is desirable to pare away a slight film of plaster from the model corresponding to the gum under the teeth to be fitted. This allows them to press somewhat on the natural gum, and gives them the appearance of growing from it. Nothing

looks worse in the mouth than a space between the neck of an artificial tooth and the natural gum.

This treatment of the model does not apply where there are roots, they of course are ground level with the gum and the teeth must be accurately fitted.

The remaining teeth having been fitted and articulated to the bite, the piece is waxed up neatly, and the polishing plate made and fixed to it, as in the case previously described.

Mode of Inserting a Complete Upper or Lower Set in the Flask, when the Teeth are not fitted to the Natural Gum.

The plaster model is trimmed down so that the alveolar ridge only appears above the edge of the lower part of flask when placed in it. The case having been fastened to the

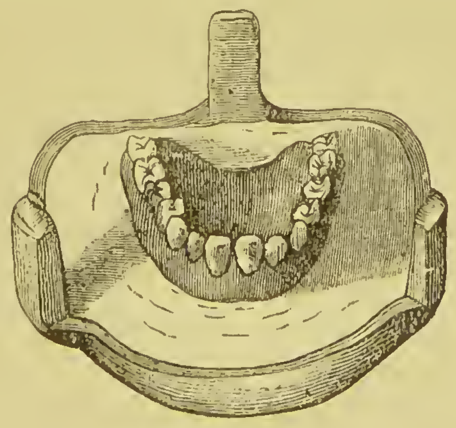

Fig. 6.

model, some plaster is mixed and a portion poured into the lower part of flask ; the plaster model with case fixed in position is now dipped into water for a moment, and is then sunk into the soft plaster. More plaster is now added to flush

from the edge of wax or lower border of case to the edge of flask, and is then smoothed off and allowed to harden (see Fig. 6).

When set, the surface of the plaster is covered with a solution of soap, and more plaster mixed, which is worked into the palate and around the teeth. The upper part of flask is then adjusted to the lower; more plaster is added to fill it up, and then the lid of flask put on. The flask should now be placed under pressure in a clamp or vice to force the joints together and keep them so until the plaster hardens. When this has taken place, the flask should be placed on the top of a stove to warm or may be dipped into boiling water for two or three minutes ; this softens the wax and allows of its coming away from the lower part of flask, and also prevents the withdrawal of the teeth from their position in the plaster. After separating the flask the next operation is to pour boiling water into the middle portion to clean away the wax, and leave the teeth embedded in the plaster. When this has been satisfactorily accomplished the case is ready for packing-in the rubber ; this operation is greatly facilitated by the flask being kept warm, for it helps to keep the rubber soft and makes it easier to pack.

Method of inserting a Case in the Flask where some or the whole of the Teeth are fitted on the Natural Gum.

There are two ways of doing this ; one is to insert the case, on the model, in the upper part of flask, bringing the plaster over the edges of teeth in order to keep them in position. This is not always a reliable way, on account o

the plaster covering the points of teeth breaking away with the pressure of the vulcanite. To prevent this occurring pieces of pianoforte wire may be used, bent so that one end comes over the edge of tooth and the other passes under the model. Separate pieces are to be used for each tooth. When

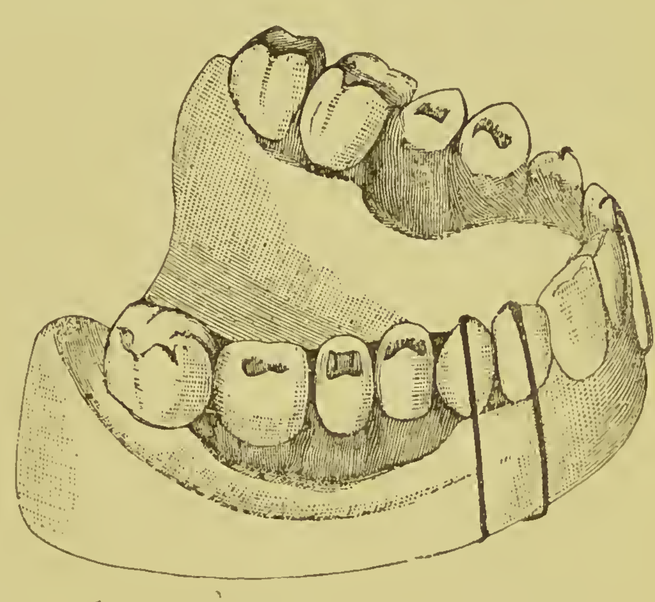

Fig. 7.

the model with these wires in position (see Fig. 7), is inserted in the upper part of flask, and the plaster brought just over the edges of teeth, it forms a support that cannot be broken, and is one of the most reliable ways for keeping teeth from rising, or rubber from getting under them.

The next way is to insert the case on its model under a brass clamp such as is shown in Fig. 8. This is done in the following manner :—

Mix up a sufficient quantity of plaster about the consistency of thick batter, and place some in the clamp and the remainder in the bottom part of the flask. The model with

the case on is now dipped in cold water, and a little plaster covered over the front part of the model and teeth ; it is now pressed into the clamp, and then both are placed in position in the lower part of the flask. The upper part of the flask should be tried on in order to see that nothing impedes it going home ; if this is done whilst the plaster is still soft it is easy to move the clamp a little one way or the other as may be required. The upper part of flask is then removed,

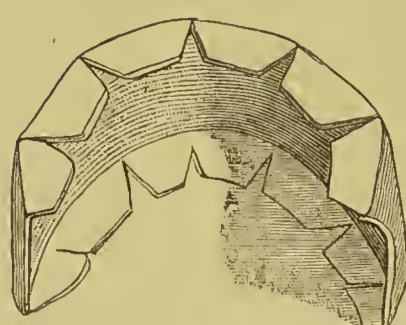

Fig. 8.

and plaster built up around the clamp so as to convert it and the model into a bevelled surface that is tapering to the top of clamp. It will then present the appearance shewn in Fig. 9.

The plaster surface and clamp are now painted with a solution of soap, and more plaster having been mixed it is placed around the model and clamp, then the upper part of flask is placed in position, filled with plaster, and the lid pressed on.

When the plaster is sufficiently hard the flask may be separated as previously described.

It will now be seen that the case is in the lower part of flask under sufficient pressure to prevent any rising of the

teeth, and the case is also presented to us in such a manner that we can see into it and pack the rubber with greater facility, than by having it in the upper part of flask.

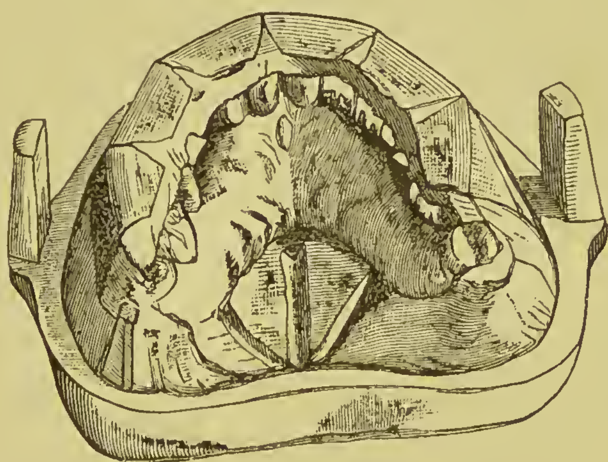

Fig. 9.

By either of the before-mentioned methods reliable results may be obtained.

We will now discuss the subject of packing the rubber.

In packing cases, as mentioned before, it is necessary to have the flask quite warm ; we also want an iron pot or other apparatus containing boiling water, and over this a plate of tin or porcelain on which the rubber can be placed to soften, after having been cut into suitable pieces.

If the case is such as I have represented in Fig. 10, a complete upper, the pieces of red rubber should be cut into sections, say $\frac{1}{4}$ inch by $\frac{3}{4}$ inch, and a larger piece cut from the rubber sheet to represent the palate of case.

The smaller pieces of red rubber should be packed one piece at a time around the backs of teeth coming up to and just covering the pins, or if drilled teeth are used the holes

should be filled with the red rubber. On no account should pink rubber be around the pins, as it is not nearly so strong as the red or black rubbers, and they would be likely to draw out.

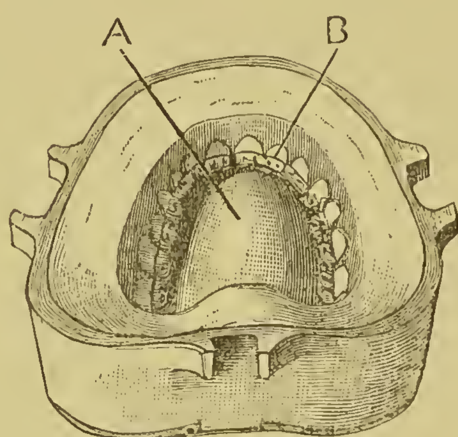

Fig. 10.

Having packed this portion (see Fig. 10.B), the next thing is to place in position the piece that has been cut out to cover the palate A. It will now be seen that all the stronger rubber is in place, and will support and hold the pink rubber which has to form the front gum. Now place small pieces of pink between, and filling up the divisions at necks of teeth, in order to prevent the red showing through. Cover the necks of teeth completely with pink and see that it is properly worked in, after which build up the remainder of gum, also in pink rubber.

In actual work we are guided in our estimate of the amount of rubber required by the amount of wax used in modelling up the case, to which we approximate as near as we can. It is of little moment, however, whether we have a small quantity

in excess or a deficiency; the next process will reveal to us either the one or the other.

This operation we will term "boiling out," and it is effected in the following manner :—

When the presumed quantity of rubber has been introduced into the flask to take the place of the wax, a piece of the linen rag that is supplied to keep the sheets of rubber apart in the box, is dipped into hot water and placed over the rubber, thereby interposing between it and the plaster model in lower part of flask when the two halves of flask are put together, which should now be done.

The flask should now be placed in a saucepan or vulcanizer of boiling water for a few minutes, then withdrawn by means of a suitable apparatus, and placed in a clamp or vice and pressed gradually, that is to say, a slight interval should be allowed between the applications of force.

If the flask closes together rather easily, we may find upon separating it and removing the linen rag that we have not quite enough rubber in the case ; this will be apparent by the presence of intervals or spaces between the portions of rnbber at one or more places, so we must add more pink or red rubber according to the situations where the want exists. The linen rag is put over it again and the flask is once more placed in the boiling water, again removed and squeezed slowly in vice or clamp. When the rubber presents an unbroken smooth surface, it is an indication that there is sufficient in the flask.

Having again removed the rag, four or five channels or " gateways " are now cut from the posterior border of case to the edge of flask, to allow for the exudation of surplus rubber Three of these are shown in fig. 9.

The reason that none are cut in the anterior part is that any exudation of rubber in that quarter would perhaps do harm, inasmuch as if the pink rubber is pressed away, red would take its place, and shew in front, which would mar the beauty of the case by giving it a blotchy and mottled appearance.

The gateways having been cut, the two halves of the flask are closed, (omitting of course the rag,) by once more squeezing in the vice. It is now removed and placed in an iron clamp and wedged quite tight with suitable wedges, or if the clamps are fitted with screws, the flask is secured in that way, and it is then ready for the vulcanizer.

The next case to be described is one where the plaster model is dried, and then instead of using a wax or metal plate, the model is painted while hot with a solution of rubber in chloroform, and then after softening a sheet of rubber, cut it into a suitable shape and mould to the model ; we have thus a rubber plate on which to mount the teeth. In arranging the teeth on this plate, we must attach them to it with wax in the ordinary way, taking care, however, to keep the wax away from the front gum.

When they are fixed and built up at the back, the palate should be coated with a solution of soap, and plaster cast into it, so that it covers the palate and just covers the crowns of molars and points of front teeth ; this is to keep the teeth in position while the pink gum is being moulded on. This is the next operation, and should be done neatly, using suitable tools and shaped pieces of pink rubber, and coating with the rubber solution any part that may require it, to make the pieces of rubber adhere firmly to each other.

After moulding up the front gum with rubber, the plaster

plug may now be removed from the palate, and we may finish the remainder of work by one or other of the following methods.

The first consists in roughing or grooving the front part of plaster model, damping it and then mixing some plaster and covering with it the front part of model and also the crowns and points of teeth.

When this is hard rubber can be packed round the palatal or inner side of alveolar ridge, when the wax has been removed. The case can now be placed in the flask direct and covered in with plaster.

A second method consists, after the plaster plug has been removed from palate of case, in placing the case under a clamp (see Fig. 8), and inserting in the lower part of flask and building up the plaster around it as previously described. It is now painted with a solution of soap, and the upper part of flask placed in position and filled in with plaster.

When hard and the flask is warmed, it may be separated and the wax removed from the backs of teeth with boiling water, and replaced by more red rubber. It will thus be perceived that the only packing required while the case is in the flask is at the backs of teeth the palate and front gum having been already finished.

Of course the flask has to be heated up or placed in boiling water with a piece of linen interposed between the two halves as previously mentioned, to allow of a parting between them and to ascertain if there is enough material. After this the flask is closed and fastened in a clamp and is ready for the vulcanizer.

The usual time for vulcanizing dental rubbers is about an hour and a quarter at a temperature of 315 deg. Fahr.,

represented on the pressure guage by 100 lbs. A slightly lower temperature and the vulcanizing prolonged to one hour and a half is, I think, preferable ; it makes a stronger and more elastic piece, not so brittle. About half a pint of water should be put into the Vulcanizer when placing the flask in. The lid should then be screwed down and the gas turned on to heat it up. When the time mentioned for cooking has expired and the gas is turned off the heat should be allowed to go down gradually until no pressure or degree of heat is indicated by either guage or thermometer. The lowering of the temperature may be accelerated by allowing cold water to trickle over the boiler, which if of copper or gun metal will not be harmed, but on no account should a cast iron boiler be treated in the same way, as it would in all probability crack it.

The boiler lid is now unscrewed, the flask taken out and placed in cold water.

STRENGTHENERS—METAL.

The insertion of these in rubber plates is a matter that requires some amount of care and consideration in order that the strengthener itself may not prove a source of weakness to the case.

For an upper piece of work the strengthener should be on one side of the vulcanite, preferably on the inferior palatal surface. The rubber therefore would be between the strengthener and the surface of model, and thus any pressure in the molar region would have to overcome the resistance of the strengthener before acting on the rubber plate, whereas if the strengthener was next the model on the superior palatal

aspect, the strains of mastication would be upon the vulcanite first, which would yield and be liable to break.

Neither should it be placed (I am speaking of upper cases) in the centre or substance of the rubber palate for such only weakens the case. Exception to this rule must, however, be made in the case of perforated strengtheners which must have rubber on either side of them.

An upper strengthener ought to conform somewhat to the shape of the palate, and should be swaged or struck up on a

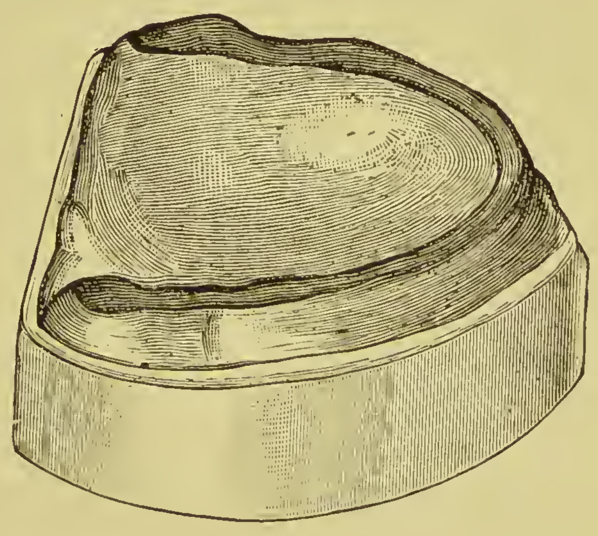

Fig. 11.

zinc or type-metal cast representing the palate of the case when properly waxed up. No. 7 plate is strong enough when it is made tolerably broad as the majority of upper strengtheners should be, but if a narrow one is used, then it should be stronger, that is, thicker in proportion, say No. 8 or 9, plate guage.

Strengtheners should be stronger in the centre than at the extremities, and have loops or pieces of wire soldered on to retain them firmly in the vulcanite.

The edges should also be bevelled with a file that the rubber may overlap, so that when the case is finished up the vulcanite will come flush with the surface of strengthener.

When the case is in the flask and ready for packing-in the rubber the strengthener should be placed in position in the upper part of flask, or in other words, on the inferior palatal aspect of case, and then the rubber packed over it, the case being then further packed in the usual way.

In some cases of prominent bite, or where the pressure of mastication comes forcibly on the rubber at the back of front teeth, with a tendency to force those teeth out, the strengthener may be swaged up so as to form a biting surface by stamping it up to a die representing the points of the opposing lower teeth.

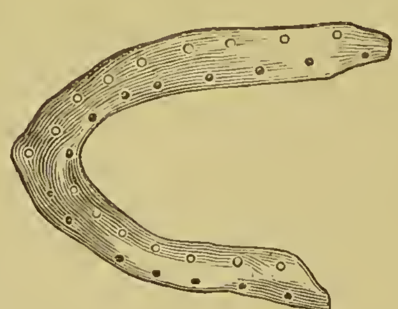

Fig. 12.

This is trimmed up and loops soldered to it. In this instance the strengthener should be sunk, by being made warm, into the wax palate of case and fitted to the bite before the piece is put into the flask.

Another form of strengthener, and one peculiarly adapted for a case with a very thin palate is made in the following manner. (Figs. 11, 12 and 13.)

The first shows model to which a thin matrix plate has been adapted, and along the alveolar ridge wax has been moulded.

A zinc die and lead counter having been obtained, a piece of No. 7 plate, either dental alloy or gold is struck up as in

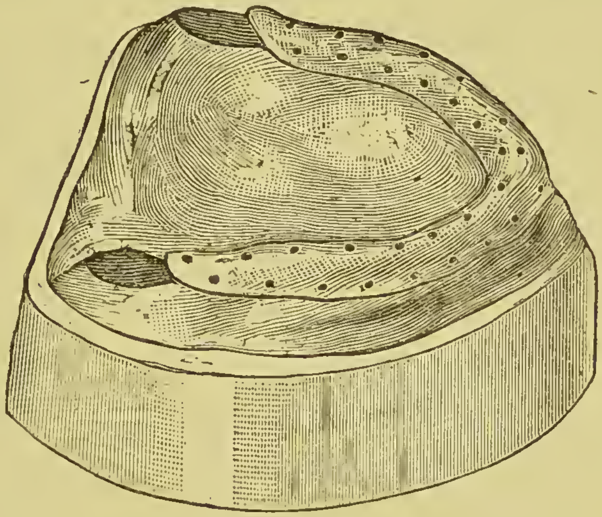

Fig. 13.

Fig. 12, and holes drilled in it. This strengthener is now placed on the model as in Fig. 13, and the plate is ready to mount the teeth upon.

This style of strengthener makes a very strong case, and at the same time does not interfere with the thinness of the palate.

For a lower case a bar may be made of pretty thick wire,about number 4 or 5 guage, placed along the necks of teeth in the substance of the rubber plate. This will be found sufficiently strong for the majority of lower cases ; or a piece of plate can be swaged and perforated and sunk into the substance of the rubber when the case is being packed.

To illustrate the use of a strengthener, I may mention the case of Mr. R.: —

In this case was presented an upper model with a space for four teeth on the right side and on the left side only space for one.

As this patient had been wearing a vulcanite piece rather large and clumsy, it was determined to make him a case of the same material, only very narrow ; to do this it was necessary to swage up a thick narrow plate which extended round to the single tooth, and formed a tongue to which it was soldered, holes were then drilled into at the extremities, and along the centre of plate.

The model having been dried and made warm, it was painted with chloro-rubber. A slip of rubber, having been reduced, by stretching, to one half its original thickness, was cemented to the model by means of the rubber coating its surface. The model was then warmed again, thus softening the rubber; the strengthener also having been made hot, was pressed into the rubber, a few more pieces were added to extend to the backs of natural teeth, and then the artificial teeth on the right side were mounted and held in their places by means of wax.

The only part necessary to pack when the case was inserted in the flask and made ready for the vulcanizer was that from which the added wax had been removed.

In this case the strengthener could not be inserted in the ordinary way, because a portion of it had to form a tongue to carry the single tooth and strengthen it.

This case when finished presented a very neat appearance, having the beauty of fit of a vulcanite case with the strength of a plate. It fitted the mouth perfectly, not requiring any clasps to retain it in position.

This method of packing rubber is particularly useful when

one has a case that presents a difficulty in packing in the ordinary way in the flask.

Cautions to be observed in Vulcanite Work :—

1st. To remove all traces of wax, grease, or dirt from the flask.

2nd. To cut away all overhanging or thin edges of plaster, in case they break away and get into the rubber.

3rd. To avoid packing-in too much rubber in the flask. It is preferable to have too little than too much ; in the first case one can easily add more, but in the latter, although one can remove the surplus by heating the flask, by placing it in boiling water and then pressing in a clamp or vice, yet one risks forcing the red rubber into the pink, thus producing a mottled and unsightly gum. Care must likewise be observed in squeezing the two halves of a flask together after packing; the pressure should be applied gradually, giving the rubber time to spread, and on no account must the piece of linen rag be omitted between the two halves of the flask. It should be dipped in hot water before placing in position, and should it not part readily from the rubber after pressure, a little boiling water poured on it will enable that to be accomplished.

4th. Just before the flask is closed for the last time, gateways should be cut in the plaster from the posterior part of case to the edges of flask ; this allows of oozing to take place only in the red rubber and thus counteracts any tendency for the red to run into the pink gum.

And 5th. The two halves of flask should fit perfectly close together or else we shall have the case thickened and the bite raised by the width of the interval represented by the imperfect closure of the flask.

GUM SECTION WORK.

Up to this point reference has been made only to the employment of the ordinary flat or vulcanite teeth, using, for the artificial gum, the pink rubber as sold at the depots.

If the patient does not expose the gums when talking, or laughing, this method of working answers very satisfactorily.

Many patients, however, present themselves to our notice, who show not only the whole of the front teeth, but a large portion of the gums also. In such cases the presence of the rubber would be objectionable, so one finds it necessary to use what are known as "gum section teeth."

One cannot imitate the colour and translucency of the natural gums with an opaque substance such as hard rubber, but such a result can be accomplished by the use of gum sections.

These sections represent teeth with the gums attached, and are made of dental porcelain. A set of fourteen gum teeth is usually divided into six sections, and great care is required in fitting them, not only to conceal the joints, or divisions between the sections, but also to get a perfect arch.

They should be mounted on a matrix plate, such as would oe blown up in the Steam Swager, or on a plate sufficiently rigid that the sections are not liable to be displaced when the case is tried in the mouth. It is perhaps the best plan to fit and adjust the upper sections first, having previously fixed the lower "dummy" composition bite on the model to act as a guide.

The upper teeth and gums are usually the most conspicu-

ous, and by adjusting these sections first, a little more latitude can be obtained than if the lower teeth were present.

The edges of the two sections forming the front joint should be ground perfectly parallel, but the joint between the canine and bicuspid on each side, should slant from the distal edge of the canine backwards, (see Fig. 14.)

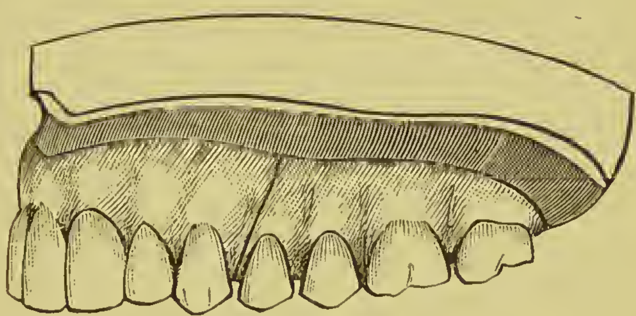

Fig. 14.

This arrangement will in a great measure conceal the joint in this region, by its being posterior to the canine eminence.

It will also permit of the bicuspid assuming a more natural position in regard to the canine.

When jointing gum sections, it is necessary to keep them perfectly steady against the flat side of the corundum wheel ; this latter should run perfectly true and be kept wet.

As each section is fitted, the inner angles should be ground off, this will make a space, into which a wedge-shaped piece of vulcanite will go and so make the case much stronger.

When the upper sections are fitted and fixed in position on the matrix plate, the lower sections may be fitted to them in a similar manner.

After the cases have been properly waxed up, the polishing

plate should be adjusted to the upper, and the pieces are then ready to be placed in the flasks, in the same manner as previously described for an edentulous set.

After the insertion of the case in the flask and the removal of the wax, the joints may be cleaned by rubbing them with a little wool moistened in chloroform.

Some thinly mixed plaster of Paris should now be inserted in the joints, in order to prevent the rubber being forced between, and so rendering them more conspicuous.

Care must be observed in packing-in the rubber to avoid a surplus, and also in closing the flask after boiling out.

This work if neatly done has a very pleasing and artistic appearance, and as a rule patients are very well satisfied with it, the colour of the porcelain gum approaching so closely to the natural as to deceive the ordinary observer.

In the selection of gum blocks, we must be guided by the shape, colour, and length of the natural teeth that have been extracted.

One reason for the direction to mount the blocks on a matrix plate, such as would be blown up in the Steam Swager, is that by so doing the cases can be tried in the mouth with safety, and any defect altered.

After vulcanizing, the cases are finished up in the same manner as for ordinary work, and should any discolouration appear between the joints of the blocks, it may be removed by the application to it of a little pure nitric acid.

The disadvantages of gum sections are :—

1st. That one cannot, without having some thousands in stock, get a set that will at the same time approximate both in size and shape of teeth, and contour of gum, to the case one wishes them for.

2nd. One cannot give expression to each individual tooth, but is hampered in this respect by the stiffness incidental to the teeth being joined together, and by having not only to fit the alveolar ridge, but also to make the joints perfect.

3rd. When one has to fit the gum teeth to a prominent alveolar ridge, they have to be ground thin in order to prevent the protrusion of the upper lip. They are then not of sufficient strength to withstand the wear and tear of use. Such a combination can only be obtained by a continuous gum facing on a platinum plate.

SUCTION VULCANITE WORK.

The term suction should be applied only to a case that adheres to the roof of the mouth without the support of clasps, springs, or fastenings of any kind.

It must not be wedged or fit tightly in between the natural teeth, nor must it be attached to roots by pivots or other fastenings. The mouths most suitable for suction work are those that are perfectly edentulous.

To obtain the best results the whole of the hard palate, (as well as the labial and buccal surfaces of the alveolar border,) extending to just behind the tuberosities should be covered by the base-plate. Any departure from these conditions, such as fitting the front teeth on the natural gum and thus breaking the continuity of the matrix plate is, (although the case may answer well enough in some instances) detrimental to its thorough effectiveness.

The adhesion of a case to the roof of the mouth is influenced in two ways.

First, by its perfect adaptation, and the pressure of the atmosphere, producing what is termed suction.

Secondly, by another element that must also be considered, and that is the peculiarly adhesive nature of the secretions of the oral glands, which will often, (although the fit of the case be defective) retain it in position.

The suction of a case is often weakened by the plate pressing unduly on certain parts of the mouth, such as where the attachments of the buccinator muscles are inserted, also on the centre of the hard palate when it is very pronounced. This latter can be accounted for when making the case, by placing over the part, on the model, a thin piece of plate prior to making the matrix plate. It is also greatly affected by the position of the teeth; the more projecting they are, the greater likelihood there is of the case being displaced. The teeth, molars and bicuspids especially, should spring from the centre of the alveolar border, and the greatest pressure should be in that region. In giving an opinion as to whether a case is likely to prove successful or not, we must be guided in a great measure by the presence or absence of the lower teeth. If the six front teeth are the only ones *in situ*, and the patient does not contemplate having a lower case, it would be seriously detrimental to the stability of the upper case if all the pressure were upon the front teeth, as there would be a great tendency to tilt the case and loosen it from the back of the palate.

The presence of eight teeth in front will answer, provided one gets a distinct upward pressure in the bicuspid region, but perfect results must not be looked for, unless we have fair pressure, such as would be produced by the presence of the lower molars. If these teeth are not present in the mouth the patient should be made to understand that the success

or non-success of the case will in a great measure depend upon these considerations.

I have already described two kinds of suction, one the result of a perfect fit, another the result of the adhesive nature of the oral secretions, and I would yet add a third means by which the suction of a case may be increased, and that is by a series of linear markings on the model, (see Fig. 4) the object of which is to produce on the finished case slight elevations, that will, so to speak embed themselves in the soft mucous membrane of the alveolar ridges and palate, converting the whole case as it were into a large suction chamber. The object of such markings is to prevent any slight displacement from affecting its holding power. I feel sure that most successful results are obtained by these means.

The production of a vacuum by means of a suction chamber for the retention of a case can be relied on only so long as that chamber retains its effectiveness and does not become filled up with the soft mucous membrane. When this does take place it is indicative that the suction chamber could have been dispensed with altogether.

Valves or discs to aid in the holding of a case in the mouth should be only used in exceptional cases, and where employed precautions should be taken that the cavity in the plate is slightly larger than the rubber disc to be used. Otherwise the rubber after a time expands and spreads over the edges of the chamber, cutting into the palate and making it sore.

When a rubber disc is used the patient should be instructed how to remove the old and to put on a new one, and should be supplied with a number for that purpose.

The depth of the chamber in the plate should correspond with the thickness of the rubber, and the stud for the attach-

ment of the disc should be on a level with the edges of the chamber, so that it does not press or touch upon the hard palate. The rubber disc when placed on the stud should assume a cup form, so that the thin edges press upon the palate and spread out, and are easily compressed up into the chamber. If these discs are worn intelligently no bad result can take place, but if the patient neglects them, then they not only become offensive but harmful. Full instructions should be given the patient concerning their use.

These discs may be used when a metal plate is worn, and, either from the presence of stumps or other causes, the suction is imperfect.

The discs may be made either of soft vela rubber, moulded and vulcanized, or what is equally serviceable, a disc may be cut out of a sheet of ordinary white vulcanized rubber by a gun punch of the proper size, viz., slightly smaller than the chamber in the plate.

The edges of the disc must be bevelled thin with a sharp pair of scissors, and a hole punched through the centre. The disc may be further weakened by having thin sections cut, out of the surface, running from the centre to the circumference.

This bevelling and weakening of the disc reduces its stiffness, and so allows of its going up into the chamber without too much pressure on the palate. The small hole in the centre is for fixing it on to a stud which has been previously vulcanized in or rivetted in, the chamber.

To illustrate the use of linear markings the following case may be taken:—

Mrs. H. This patient was wearing a temporary vulcanite set, which answered very well, although it was inserted in

the mouth two days after the extraction of the teeth. It no longer fitted, owing to absorption of the gums, so she thought she should like a gold upper suction set if it could be made. A case was therefore constructed with six flat teeth mounted in front and tube teeth at the back, flat teeth being put on in front owing to the closeness of the bite. This new case had two defects: first, it did not fill out the lips and cheeks sufficiently; and secondly, it did not hold in the mouth as firmly as the vulcanite set. I therefore removed the tube teeth, and with a sharp thin wheel on the dental engine, grooved them at the sides, so that the rubber which I intended to mount on the labial aspect of the plate might be able to run in between them and hold them in position. After I had trimmed away the buccal and labial edges of the plate to the required size, I made, with a fret-saw, a series of nicks extending into it one-sixteenth of an inch; these saw marks extended completely round the case. The plate was then replaced on the model, and with a sharp pointed broach, a line was made corresponding with the exact size of the plate.

The plate was again removed, and another groove, or mark, was etched into the plaster model, one-sixteenth of an inch within the circumference of the first marking. The tube teeth were now replaced and fastened on with sulphur. The plate was then replaced on the plaster model and waxed up round the buccal aspect, as much as was needed to restore the contour of the features, and a much smaller quantity of wax to just cover the posterior edge of the plate, and conceal the saw marks made therein. This case was inserted in the flask on the model, and packed with rubber in the ordinary way, and when finished it represented a gold plate with rubber in front, and an extremely narrow rim

round the back. Formed by this rim of rubber were the lineal markings spoken of previously, when referring to vulcanite suction work.

It was found that the sulphur which cemented the tube teeth to the plate had not been destroyed, but if this had occurred provision was made for retaining them in position by the grooves which were cut in their sides for the rubber to run into and clasp them.

The fit of this case was in every way excellent, and the expression of the features all that could be desired.

Method for Producing the Fac-simile of an Old Case.

Case in Practice.—Here the patient had become so used to the position of the teeth on her old cases, that it was found necessary, in order to give her satisfaction, to copy her old upper piece to arrive at the result required. An impression of the patient's upper jaw was first taken and a plaster cast obtained. The old upper case was then placed on the model and fixed there with a little hard wax. Facets were then cut in the front of the model to serve as guides. Some soft A 1 composition was then taken and moulded so that it covered the surfaces of the six front teeth and extended downwards into the marks, or facets, on the front of the model. When hard, this piece of composition was removed, and bevelled to a feather edge at the distal extremities of the canines. It was then replaced on the model and dusted with French chalk ; more composition was then moulded over the faces and crowns of the bicuspids and molars, as well as into

the facets at the sides of the model, and of course extending some little distance on to the front section. This plan was carried out on both sides. When quite hard, these pieces as well as the old case, were removed from the model, the surface of which, as well as the composition, was then lubricated, the former with soap and the latter with vaseline. They were then replaced, omitting the old piece, of which the composition represented an impression, and were fixed firmly with hard wax. Some plaster of Paris was then mixed, and poured into the composition impressions as well as on to the surface of the alveolar ridge of the model, and allowed to thoroughly harden. When quite hard, the sections of composition were removed one at a time, and then a slight tap on the bottom of the model was sufficient to loosen the plaster piece. This, when trimmed up, gives us a sufficiently accurate duplicate of the old piece in plaster.

The same course must be adopted if it is found necessary to copy the lower case.

It is usually necessary to proceed in the manner I have described, in the case of those patients who have worn the same case for a number of years, and have become habituated to "the feel," and also to the expression it gives to the features, and who at the same time are not willing to leave the old cases with you for any length of time. Such a case I had to undertake a short time since, and although I mounted the teeth so as to give her a more pleasing expression (fortunately trying the case in the mouth with wax), yet the friend who accompanied her thought, and it naturally biassed the patient, that the old case looked more natural than the new. The patient was so deaf that I could not get her to understand that she must not bite so hard, and she destroyed

the appearance of my waxed-up case. Seeing how the matter stood, I told her that as she seemed so used to the position of the teeth on the old case, it would be best for me to mount the new teeth in a similar manner, which I did after the method I have attempted to describe, the results in this case being equally satisfactory to both the patient and myself.

Method of Remodelling a Case on which are mounted Gum Blocks.

When removing these from Vulcanite for the purpose of remounting them, it often happens, no matter how careful one is, that a block will crack, or some other mischief occur. To avoid this, I have latterly been treating the case as one block, and have so cut and trimmed away the vulcanite from around the gum blocks, by filing or with a sculptor, that it may afford plenty of strength and room for the new rubber.

There is some difficulty in packing rubber round this in the ordinary way owing to the absence of spaces between the teeth. So in order to overcome that, it is as well to do it in the following manner.

First dry the model and paint the gum with a solution of chloro-rubber, then take a thin sheet of rubber, soften it and mould to the surface of gum. The reduced piece, with the blocks on, is now placed in position, and built up to the bite with additions of rubber beneath, if found necessary, and then the pink rubber, or red, (if pink is not required) is packed around the front of the case, and the back or lingual aspect of the case moulded up with wax in the ordinary way. We shall thus have a case ready for the flask having its

buccal and labial aspects packed and only leaving the lingual part to be packed after the removal of the wax in the usual manner.

This is a very satisfactory method for remodelling a case such as I have described. Care must of course be taken that the blocks are made to approximate properly with their opponents in the opposite jaw, and at the same time the new rubber should cover and quite conceal all portions of the old.

The Insertion of Swivels in Vulcanite Dentures, for the Attachment of Springs.

For convenience of description we will divide the Swivel into its various parts, under the names of Head and Bolt (Fig. 15), Eye and Shaft (Fig. 16), and the Washer (Fig. 18). Fig. 17 represents the complete Swivel.

In ordinary cases where there is sufficient room for the insertion of the bolt, it is only necessary to reduce its length by a third.


Fig. 15.


Fig. 16.

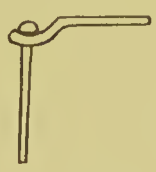
Fig. 17.


Fig. 18.


Fig. 19.

The washer is made by punching a hole through a thin piece of gold or dental alloy, and trimming it round to correspond to the eye of the swivel, or a round disc with a hole in it can be cut out at once by a suitable punch (Fig. 19) placing the thin metal on a piece of lead while so doing.

The washer is for the swivel eye to work smoothly against, and to prevent the friction which would result if the swivel rested against the vulcanite.

After slipping it on the bolt it is pressed tightly against the swivel eye and kept in its place by nicking the bolt with a sharp sculptor, the bolt may then be roughened or flattened at the end in order to retain it firmly in the vulcanite.

After the case has been waxed up (see Fig. 5) a hole is made in the wax with an old broach or piece of wire made warm. The place for this is between the second bicuspid and first molar, and these teeth may, if found necessary, be cut away at their necks in order to afford sufficient space for the bolt between them.

The swivel bolt is now slightly warmed and pressed into the hole so made, taking care that the shaft of the swivel works perfectly parallel and just allows sufficient space for the thickness of the gold spring between it and the teeth.

This precaution is very important, inasmuch, as if the spring does not work properly, it either rubs against the teeth, or perhaps, what is still worse, cuts into the cheek. To a total disregard of this important fact is frequently due the dislike with which springs are regarded by many.

When there is a very small amount of room, as in a case of a somewhat prominent alveolar ridge, and the artificial gum has to be very thin in front of it, it may be found necessary to fix the swivels in a different manner, that is by reducing the bolt until it is $\frac{1}{8}$ of an inch, and after drilling a hole in a piece of plate $\frac{1}{4}$ inch square, rivetting the swivel to it and then soldering. This piece of plate takes the place of the washer previously described, and should be hollowed out with a file at the sides so that it presents four projecting

points. These points are bent backwards so as to form a clamp. (see Fig. 20).

Fig. 20.

This may now be pressed into the wax in the proper position, and will then hold the swivel securely in the vulcanite. The advantage of this form of fastening is that the swivel can be placed high up or low down on the alveolar border, and yet not come in contact with the plaster model.

Fig. 21,

In cases, again, where a swivel has to be placed between a natural tooth and an artificial, as, for instance, in a lower case, where the second bicuspids are in position, the standard to which the swivel is attached should be made in a different manner. Take a strip of No. 7 gold or dental alloy plate about half an inch long, $\frac{1}{6}$ wide. To one end of this strip (see Fig. 21) the swivel should be rivetted and soldered, and to the other end a piece of pivotting wire should be soldered; this, the fastening, is to hold the swivel firmly in the vulcanite and it can be passed between the first and second molars, or where there is sufficient rubber to hold it.

Other devices for mounting swivels are useful where one has, say, a first molar in position, the spring having to work outside it.

In such a case the swivel may be soldered to a band encircling the tooth with a stop formed by a piece of wire soldered to it to prevent the shaft of the swivel from dropping too low down, and so allowing the spring to cut into the substance of the cheek. Another method consists in having a swivel with an extra long shaft, which allows the head of the swivel to be in its proper position, and yet after describing a half circle round the front of tooth, the shaft may be bent again so as to become parallel. (See Fig. 22.)

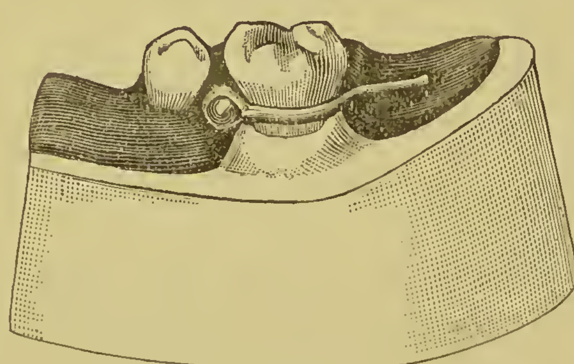

Fig. 22.

To the straight part of this long arm, or shaft, as it is called, the spring may be attached, and the same precaution must also be taken to prevent it from throwing the spring out of place.

Before soldering swivels either to a washer, or to a plate for retaining them in the vulcanite, a little moistened whitening must be introduced between the eye of the swivel and the plate to which it is to be soldered ; this should be done effectually, otherwise the swivel will be soldered up and rendered useless.

The use of springs is indicated in those edentulous case

where one has a patient who cannot tolerate an upper plate extending backwards on the palate, or where one has considerable absorption of the alveolar ridge in the lower. Another instance occurs where one has a projecting bite, or the mucous membrane is of a hard, dry, thin character, or one has reasonable grounds for suspecting that the patient will, either through nervousness or other reason, not persevere in overcoming the habit of the tongue to move the lower case about. Again they must not be dispensed with without due investigation in cases when the patient has been accustomed to their use for many years.

In fact, where any of these considerations are likely to crop up it is just as well to mount swivels on the case, and if they are not required, the patient can, after a short period of probation, have them removed.

I have already said that the usual position for the swivels is between the second bicuspid and the first molar. If a line be drawn across the case from one swivel to the other it will be found that the set is very fairly divided into two halves, and the spring will thus balance the cases.

The swivels should be so adjusted that a nice even bow or curve can be given to the springs. These latter should be kept as long as the patient can wear with comfort; it is better to use them as weak as possible since they do not tire the mouth so much.

The springs as well as the swivel, are usually obtained from the dental depots and numbered from No. 6 to No. 10 or 12, the strength increasing as the number rises. No. 7 and 8 are those mostly used. To prepare them for attachment to the set, the ends of each should be smoothed with a fine file.

The springs are attached to three of the swivels by screwing them the reverse way, viz., to the left.

The shaft of the fourth swivel must be reduced if too large, so that the springs can be pressed tightly on it, without screwing. It is convenient and saves time if one makes a habit of utilising either the right or left lower swivel to press the last end of the spring on to.

By knowing which end this is, one can remove them with facility. To remove it take a half round sculptor and force it off the shaft. To remove the others take a firm hold of the spring between the thumb and finger, close up to the swivel and unscrew to the left, the same as screwing them on only the spring must be pulled at the same time.

Devices for Strengthening the Case and Teeth where one has a very Shallow Bite.

1st example, where the lower front teeth bite close on the upper alveolar ridge. For such a case a small plate either of

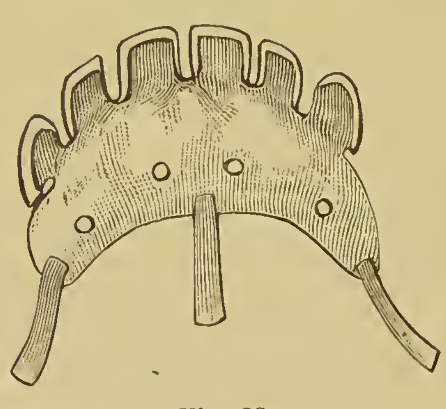

Fig. 23.

gold or dental alloy may be swaged, to which the teeth are to be soldered.

The plate should have holes drilled in it and be chamfered on its superior palatal aspect, or have loops or strips of plate soldered to its inferior palatal aspect to secure it in the vulcanite (see Fig 23). It is then placed on the model and the case is waxed up in the ordinary manner.

The same arrangement only on a smaller scale can be used for one tooth by soldering a back and tongue piece, to go into the vulcanite (see Fig. 24).

Fig. 24.

2nd example. For strengthening the tooth in the lower where it has to be filled into a narrow space between two teeth, the following plan will be found useful. First fit and back the tooth then solder to the back two pieces of gold wire (Fig. 25), these can be bent at right angles when waxing up the case.

In taking impressions for repairs, the case to be repaired should always be in the mouth and be withdrawn with the impression. By that means the plate assumes its proper position in relation to the part to be added.

When the addition of one or two teeth is contemplated, the impression may be taken by first drying the case, then fixing to it some softened composition, say a little more than will be required to fill up the vacant space.

While still soft, insert the case in the mouth, and having lubricated the tips of the fingers with a little vaseline, mould the composition into place; now direct the patient to bite into it, and keep the teeth closed until the composition is hard. By these means a reliable model and bite can be taken at the same time, into which a little plaster is run, and a bite prepared.

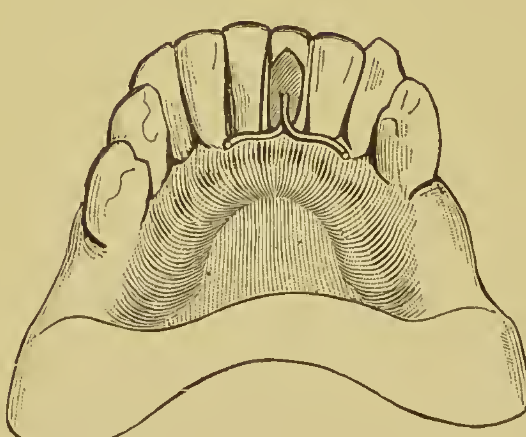

Fig. 25.

In adding a tooth to a thin vulcanite case the following plan may be adopted.

Take an impression as before mentioned, into which cast

plaster. Now adapt tooth to model and back it with a piece of gold or dental alloy. Next fit a saddle or tongue of metal extending from the back of the tooth to a strong part of the work.

If the case is thick enough it may be let into it a little so as to make the edge of the metal flush with the plate ; if not, it must fit on the surface. Now drill three holes in the tongue of metal (see Figs. 26, 27, 28) next place the piece of plate in position. Mark the two first holes in the vulcanite, and drill through the case. Two soft silver pins should now be soldered into the plate, corresponding to the holes drilled in the vulcanite.

These having been found to fit satisfactorily, the remaining hole is now marked and drilled in the case, and another silver pin soldered into the remaining hole in the tongue of metal.

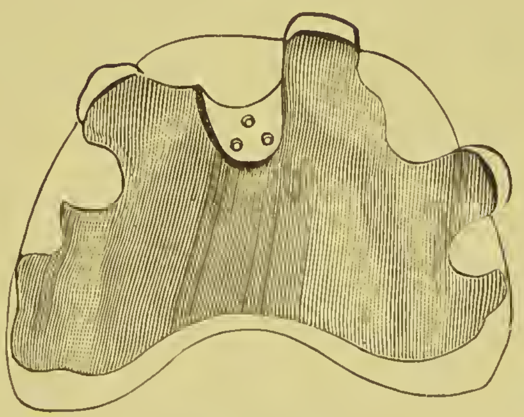

Fig. 26.

Fig. 27.

The silver wires should be left sufficiently long, so as to form a head when being rivetted.

The tongue of metal is placed in position on the vulcanite plate, and the added tooth cemented to it with hard wax. The

tooth and plate are now removed from off the case and invested in brickdust and plaster, then dried, heated up and soldered.

When cool it is placed in sulphuric acid to clean, then filed up and polished, when it will be ready to be finally rivetted

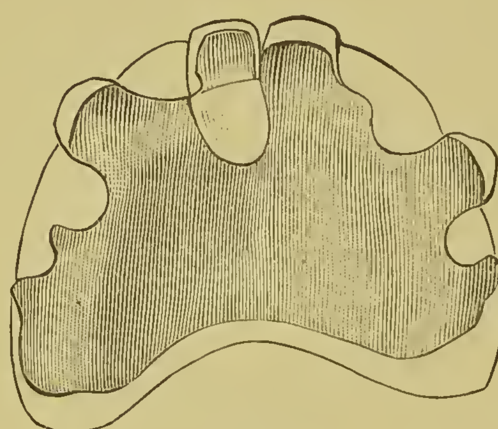

Fig. 28.

to the vulcanite plate. The holes in the vulcanite plate should be chamfered on the superior palatal aspect in order to get a good head to the rivets.

The operation of rivetting is best accomplished by placing a broad-ended punch in the vice, and resting the plate on the end while using the hammer.

When the plate is made secure to case it is finally finished and polished in the usual manner.

Another way of fixing a tooth to a vulcanite case, when time is an object and when the thickness of the case will permit it, is to cut out the rubber at the back of the tooth to be added in such a manner that it forms a dovetail.

The pins of the tooth are then bent in a suitable manner,

and if they are not long enough they can be made so by soldering thin pieces of dental alloy wire to them.

The tooth is then made hot, and melted fusible metal is poured or pressed into the recess cut out of the rubber. This holds the tooth firmly in its place, and the whole operation may be accomplished in half an hour. To hold the tooth in place while pouring in the metal a small plaster mould may be used.

DENTAL MECHANICS;

PART II:

THE DENTAL LABORATORY.

BY

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DENTAL MECHANICS.

THE DENTAL LABORATORY.

In selecting a room to fit up as a laboratory, one must be guided by certain considerations highly essential for the comfort and well-being of its occupants.

Firstly, it should be spacious enough to contain the bench, lathes, furnaces or stoves, rollers, and other necessary things, and yet afford room to move about freely.

Secondly, it should be lofty, well ventilated, have a good light, and be situated on the ground floor. These are the requirements needed, for no one can do satisfactory work if not in good health ; and an easy way to lose that essential is to work in a badly ventilated room, filled with foul air and the deleterious products of combustion of gas, etc.

So much for the room ; and now to furnish it.

To get through the work quickly and well, it is requisite that all the appliances necessary for one's use should be at hand, and easily found without appreciable loss of time There ought to be a place for everything, and everything should be replaced after use.

The Work-bench and its Construction.

The most suitable woods for making a dental work-bench are birch, beech, or American pine ; the last named is perhaps the best, as it can be obtained in widths of one, two, or three feet, and in thickness as desired. Two inches is a fair thickness ; getting the wood in one piece makes a considerable difference both in time and labour in its construction.

The wood is first of all planed on its upper surface, and then a series of sections are cut out; this enables the workman to approach nearer to his work and also allows more

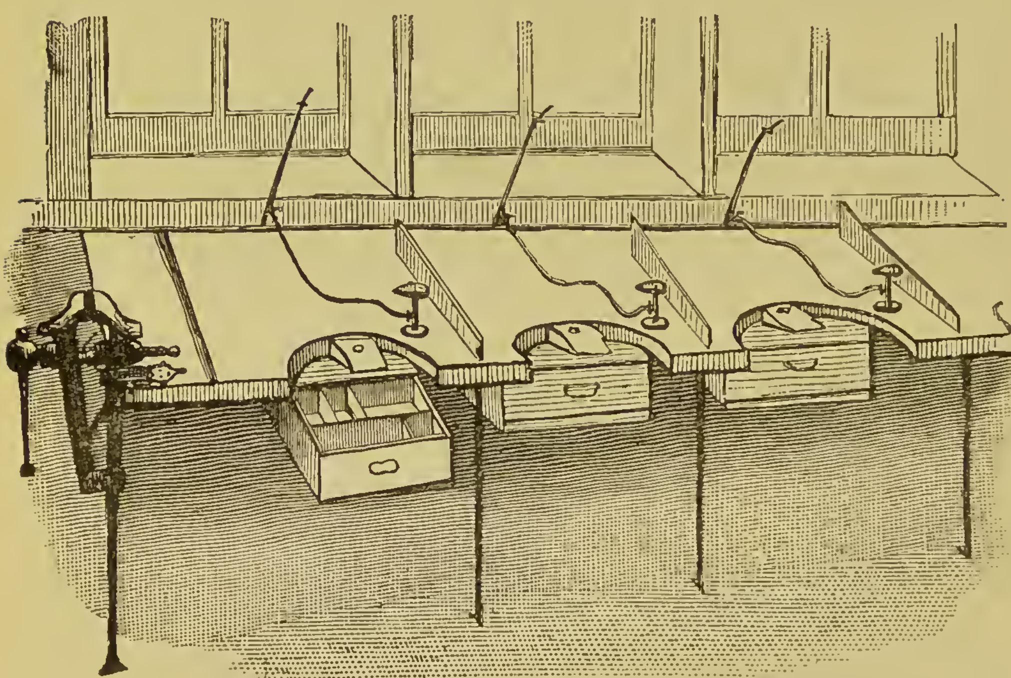


Fig. 1.

bench room. (Fig. 1.) Some workmen suspend [sheep's-skin from one side of this semicircular space to the other, the object of which is to catch anything that may be dropped,

to retain a few tools, and to hold trays for the reception of filings, etc. Such a skin, however, soon becomes the receptacle for all sorts of odds and ends, and should be avoided by the skilful workman in favour of the nest of drawers to be described further on.

The bench should be firmly fixed to the floor, by means of brackets attached to its legs, and should also be fastened to the wall when possible, in order to have that amount of steadiness and rigidity necessary to withstand the strain exerted when using the vice.

Its height from the floor should be about three feet; this will allow the workmen to sit down and work without stooping, a very necessary thing to be taken notice of, especially with a pupil entering on his apprenticeship ; he should be made to sit so that his back is perfectly straight, it prevents him acquiring a stooping habit, and is conducive to the preservation of his general health.

The legs of the bench may either be made of wood or iron; if the latter is selected then the tubing sold at the ironmonger's under the name of "gas barrel" is very suitable for the purpose. It can be obtained cut in suitable lengths, allowing three inches at each end to be flattened and bent at right angles in order to get the necessary hold for the screws. To bend the ends of the tube it should be placed in a fire and made red hot, and while in that state should be flattened on an anvil, and then bent at right angles. It should then be heated again and three holes punched in each end with a steel punch of a suitable size; these three holes are for the screws.

The legs are now ready to be screwed to the bench and

floor, and make excellent supports, taking up but a small amount of room.

The bench should be fitted with nests of drawers, (see Fig. 1,) corresponding to the number of seats required by the workmen.

The upper drawer should be deepest and divided into sections to accommodate the tools, etc. Thus, in one compartment are placed the files, in another the sculptors, in another pliers and nippers, and so on, while one small division is left for odds and ends, drills and clamps, too small to mix up with the other tools.

The lower drawer being shallow should be lined with brown paper, pasted on, or the joints may be filled in with putty to prevent any leakage through them. This drawer is pulled out to catch the gold dust and other *debris*, while plates are being filed at the bench-pin. This latter is a wedge-shaped piece of wood, usually beech, about three inches wide, and one inch thick where it joins the bench, is six inches long and is bevelled in front to a sharp edge. It is fixed horizontally into the edge of the bench by means of a slot cut into the latter with a morticing chisel, and so adjusted that the upper surface of the pin is flush with the top of bench.

The object of the bench-pin is to afford a suitable support for the work to rest against while being filed. There is often a round hole drilled in the centre of it, for the reception of a small beak-iron used in adjusting clasps to difficult curves and for flattening wire.

It is necessary now to attach a vice to one corner of the bench, that being usually the most convenient and handy place; and it should be securely fixed both to the bench and (in the case of a leg-vice) to the floor also. For dental pur-

poses the leg-vice is the most useful ; it is not so expensive as the parallel one, nor so likely to get out of order with the rough usage that it will meet with.

To protect the edges of the jaws of the vice, they should be covered with pieces of thick lead bent at right angles ; these protection pieces in no way interefere with the use of the vice, but serve to keep the jaws sharp and free from flaws.

Our next work is to adjust the necessary gas apparatus for heating and lighting purposes. This is not a formidable or difficult undertaking if we only proceed in a business-like manner.

Nothing makes better or more durable gas fittings than "gas barrel." It can be procured in any length or size, and tapped with a thread at the ends, ready for fixing. All one has to do is to get, according to the number of the seats at the bench, a corresponding number of brass "three-way pieces." These are to connect the lengths of barrel together opposite each bench, and to give the necessary adjustment for the two taps that are to supply each seat with light and a soldering flame. (See Fig. 1.)

There are various burners for soldering purposes, but the general principle of each is to produce a large soft flame; some of these burners are open at the ends, others have a chamber at the end filled with iron wire through which the gas passes, while the same purpose is arrived at in others by having a cap (such as that represented in Fig. 1) perforated with a number of fine holes.

Now that the bench is supplied with its soldering flame (which I would here remark ought to be placed within convenient reach of the artist while sitting down), one must take

into consideration the various blowpipes and the special advantages connected with each. For himself, the author prefers the simple taper brass tube about 10 inches long, bent at right angles at the end, and with the mouthpiece covered with a silver ferrule or rubber tube to prevent the lips coming into contact with the brass ; these can be procured at any depôt or tool shop. Anyone brought up to the use of this simple appliance can do the work efficiently and well, regulating the flame to the greatest nicety. It takes some little time to get into the use of it, but it is generally found that after a while by practice, the expenditure of breath can be so regulated that it becomes quite a simple matter to prolong the blowing for a considerable length of time without fatigue ; in fact quite long enough to complete the soldering of any dental plate. The learning to blow and take in air while expending it through the blowpipe is only to be gained by constant use. On the other hand, there are many who do not seem to have the capacity to learn the use of it, or perhaps are physically incapable of expending the amount of breath necessary ; for such, the mechanical blowpipe of Mr. Fletcher is perhaps the best ; that requires some practice to use properly, but it has the advantage that it dispenses with the use of the mouth and lungs.

Our next work is to furnish the laboratory with the appliances necessary for melting both the precious and coarser metals, and a description of the furnace designed by the author to fulfil these requirements may not be out of place here. It has for a recommendation the fact that it will stand the hardest work, and will melt anything up to ten pounds of cast iron ; it is at the same time very inexpensive and comparatively easy to construct.

It stands 27 inches high, and is 15 inches square, so that when allowing two and a half inches for thickness of fire-bricks, it gives an inside diameter of 10 inches, and a depth of 15 inches.

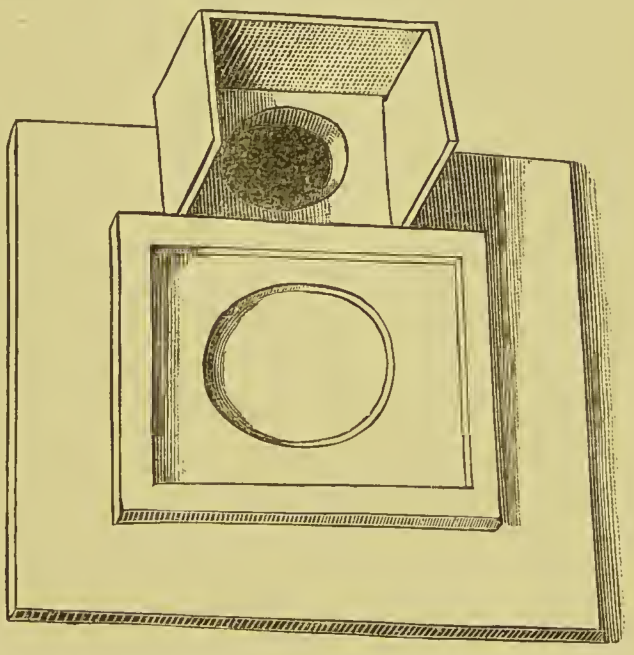


Fig. 2.

The outer case is formed of sheet iron, and can be obtained at any good ironmonger's upon supplying him with a diagram and measurements.

The case is rivetted together at the back, and the inside is lined with firebricks coming up to, and level with, the top of the case.

The top of the furnace is made of a single casting (Fig. 2) with a round hole cut out of the centre, for a smaller lid to fit on to and close in, and at the back part of the iron casting is a raised rim to carry the flue. The whole furnace presents a neat and compact appearance. (Fig. 3).

By referring to the Figure it will be seen that a portion of the iron case in front is removed to allow of a good draught, but still a sufficient portion is left to cover and support the brick lining. At the upper part of this aperture a thick bar of iron passes across from each side, both back and front, resting on and let into the firebricks; these are to support the furnace bars.

The firebricks are fitted into their places and joined together with soft fire-clay.

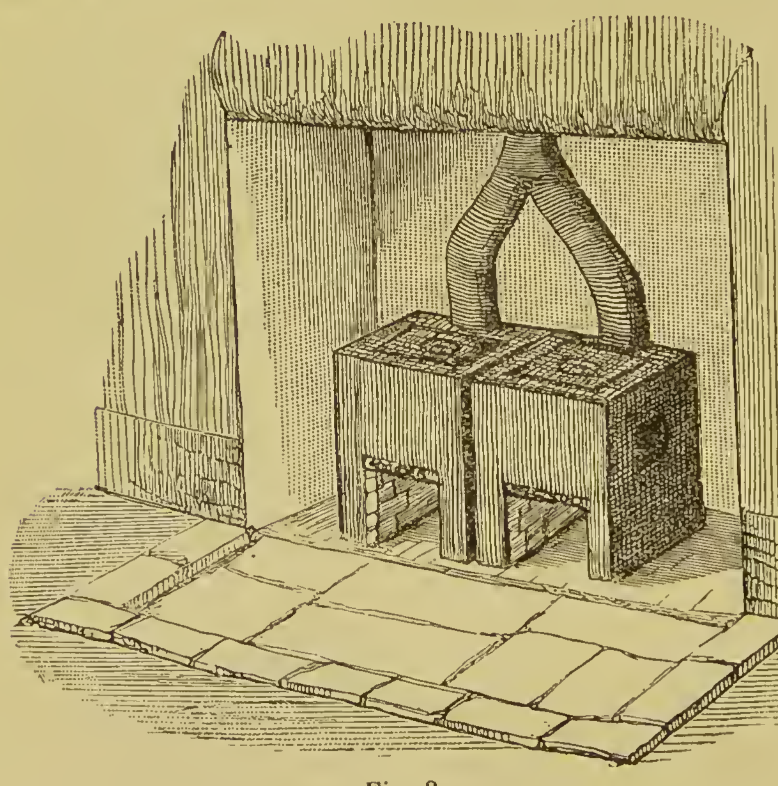


Fig. 3.

The flue is made of ordinary iron piping supplied for that purpose, and can be adjusted to any grate.

The top of the furnace may be used for boiling water, drying models, and various other useful purposes. A modi-

fication of this furnace is used for baking mineral teeth and continuous gum-work, the difference being an opening cut out of the side of the iron jacket (see Fig. 3), to allow of the introduction of a muffle. In this case the fire-clay bricks are so fitted that they form a recess for the back and front portion of the muffle to rest on. The muffle should also be supported along its whole length by firebricks resting on two

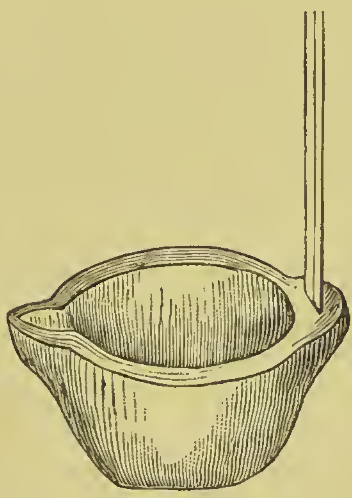


Fig. 4.

of the furnace bars, which bars should be fixtures. The fuel used for these furnaces is the ordinary gas coke, unless a prolonged heat is required, when the heavy furnace or foundry coke is mixed with it ; this however, only applies when the muffle furnace is needed to bake artificial teeth, and when a high temperature is required for a long time and it is not desirable to disturb the fire.

The ladles for melting zinc and lead (see Fig. 4) are made of cast iron, about half an inch thick with an upright handle cast on ; this handle is placed in position in the mould when the iron is poured, and is thus fixed to the cast-iron bowl. This

handle one must supply to the founder when the mould is given in to the foundry.

The pattern of the mould for such a ladle could be obtained from any wood-turner for a shilling or two, and will in time save pounds, for these ladles last six or seven times as long as those of wrought iron.

The size of the ladle should be regulated by the opening in the top of the furnace, that is to say it should be small enough to withdraw from the furnace without a risk of spilling its contents, and the handle should be of such a length as not to get too hot to hold comfortably when in the furnace.

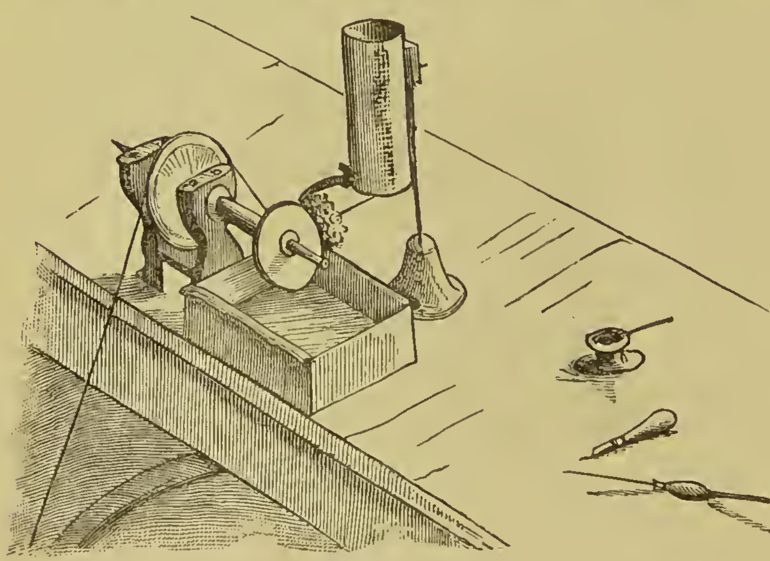


Fig. 5.

A bench to carry lathes (Fig. 5) for grinding and polishing is our next consideration, and this any carpenter can make in the course of a few hours. The lathe-bench may be about four feet long and one and a half feet wide ; it will carry five lathes, two on one side and three on the other, one being a polishing lathe ; this latter should be placed at the end so as not to be in the way of the other four.

The kind of lathe-head that the author recommends for fitting teeth is the cone-journal; it runs true and steady, and the chucks are fine enough to carry the smallest button wheel equally as well as the largest.

It is furnished with a chuck that will carry an ordinary engine bur ; this is a great advantage in "fine-fitting" tube teeth, and much better work can be done with a lathe of this kind than with the heavy old-fashioned dentists' lathe, because any looseness arising from wear can be taken up at once.

The polishing lathe should carry a long square chuck working on a centre (see Fig. 6) this is to carry two or three

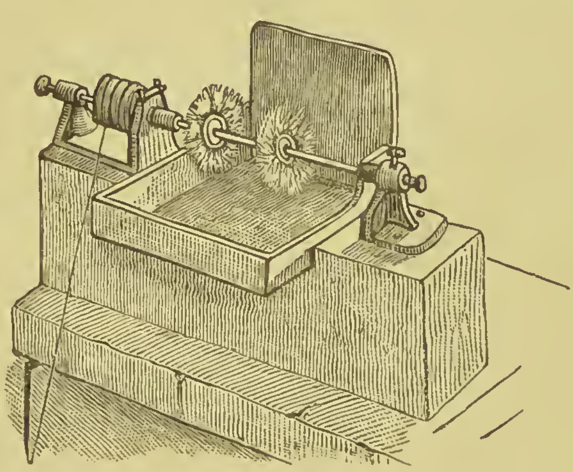


Fig. 6.

brushes, two for pumice (one being stiffer than the other to get a surface on the plate) and a soft one for polishing with whitening or rouge. The chuck crosses a box which forms a receptacle into which the polishing material falls as it is thrown off the brushes. This box should be made strong and watertight to retain the damp pumice, which can be used several times over. The mandril to carry the brushes being four-sided, it is necessary to cut a square hole in the hub of

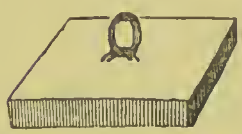
the brush, (this can be done in a few minutes with a flat sculptor) the shape of the hole preventing the brush turning. The mandril is also fitted with several pieces of loose brass tubing ; these being placed between the brushes to separate them, the whole is held in position with an adjustable screw at the end of the chuck.

Each of the lathes for grinding must have a small cistern made of zinc or lead to fit under the wheels, the edge of the cistern being rounded (see Fig. 5) in order to form a support for the hand to rest on when using the wheel, and should also have a water supply to moisten a piece of sponge which the corundum wheels should come in contact with, for if the wheels are used without water they get hot, the shellac that binds the corundum particles together becomes fused and the surface too slippery to cut at all.

The lathe-bench should be placed in a good light, and have a gas supply ; this bench should be furnished with a camel's hair pencil ; a small pot containing a paint made of carmine, or vermilion, and oil : a needle file to clean out tubes ; and a chamfering tool made of a small round file, cut into three facets at the end, in order to countersink the edges of the hole in the tube tooth, where it will come into contact with the solder round the pin. A chipper (Fig. 7) to reduce tube, or long teeth, should also be affixed to it. These articles should be always kept in one place, for much time may be wasted in looking about for them and they are very often required.

The lathe-heads having been described, we now require driving wheels to set them going. The usual fault with lathe wheels is that they are too small, the larger and heavier the wheel the less labour there is in working the lathe.

Such a wheel may be mounted on cast iron bearings and



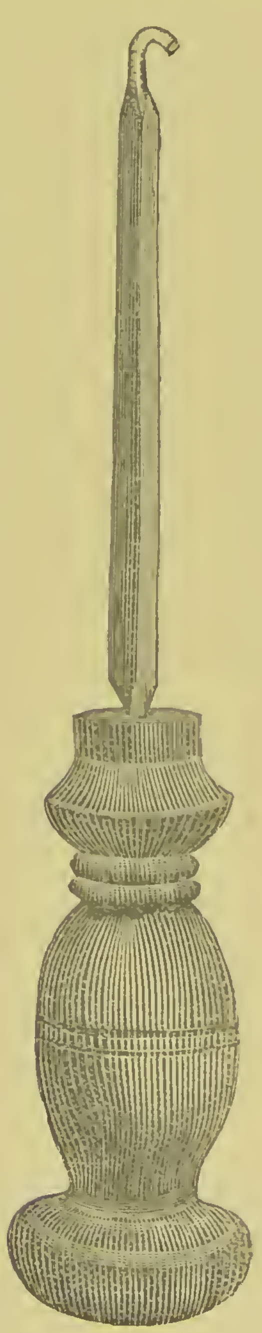


Fig. 7.

attached to a wooden frame so that it can be moved to any position required. The gut band for driving is obtained from any good tool shop, or depot, and the ends are joined together by means of a steel hook and eye. Some little care is required in screwing these on so as not to cut the gut; it is better to have the hook and eye of sufficiently large a bore to form a thread on the gut without cutting it. When the gut is screwed through, a red hot iron wire should be made to perforate the holes in order to clear them, and at the same time it hardens the gut and makes it less likely to draw.

The next piece of furniture we want is a plaster bench. This may be about four feet long by two wide, and made of pine one inch thick. This bench is much improved if covered with sheet zinc which allows it to be kept clean and prevents moisture from soaking into it. A piece of wood about one

Fig. 8.

foot square and one inch thick should be fixed on this bench to trim plaster models upon, two or three basins, and a water jug, likewise a good strong knife or spatula to mix plaster with, are required for this department. The india-rubber

basins sold for mixing plaster in are very useful, there is no fear of breaking them.

We also require a large hammer, or stamper, and a block for swaging plates—Figs. 8 and 9 represent those used by the author. The iron block, grooved to fit the thigh, weighs about 20 lbs, while the stamper weighs about 7lbs. When using these the foot should rest upon the toes and not flat on

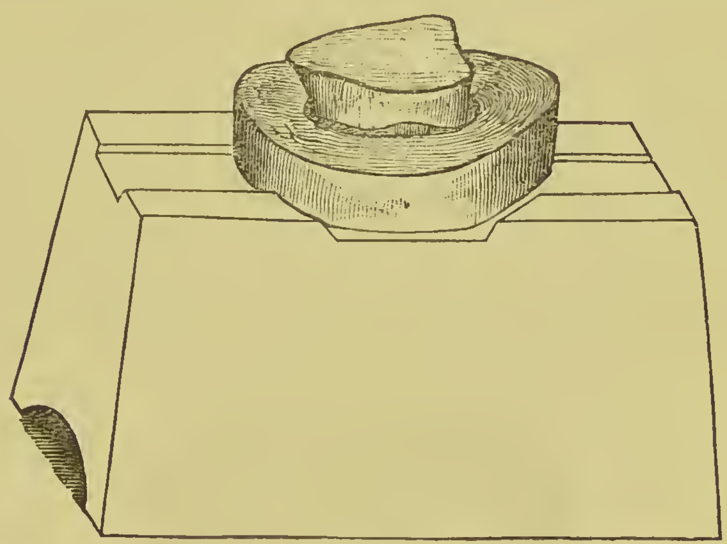


Fig. 9.

the ground; this precaution prevents jarring the knee and ankle joints. If a hammer is used, the block or anvil may rest on a thick piece of wood, or bag of sand, to give it steadiness and to avoid noise.

Having given a description of the fitting of the workroom it would not be complete if a list of the tools necessary to do our work with were omitted. The dentist's ordinary tools and appliances will come first, and then those which, although not absolutely essential when a depôt is handy, would be of the greatest service, both in saving of time and expense, if the

dentist was situated where he could not obtain all he wanted.

The ordinary working tools in a Dental Laboratory are :—

Shears, straight and curved.

Nippers, large and small.

Pliers, plate cutters.

Straight, half round, and wire pliers.

Punching pliers, large flat pliers for drawing wire.

Sculptors, half round, large and small ; flat, large and small; and a triangular and knife-edged graver.

Drill-stock, and drills.

Chamfering tool for metal.

Files ; rough, medium, and smooth, for gold or plate work.

Rasps ; rough and medium, for vulcanite work.

Pin-vice, for holding wire.

Saw-frame, and piercing saws.

Metal files, coarse and smooth for steel and brass.

Hammers, rivetting, chasing and large.

Broaches. Blow-pipe.

Horn mallet. Tweezers.

Grindstone, to work by the foot.

Oilstone, Arkansas, or Turkey.

A steel pointer for marking holes.

A couple of scrapers for vulcanite work.

Pair of compasses. Calipers.

Double-ended wax modeller.

Small screw-plate and taps.

Slate for borax. Water bottle and brush.

Water-of-Ayr Stone.

Plate elevator. Plate punches.

Brass modeller for patterns.

Common penknife. Bite-frames.
Draw-plate, and guage-plate.
Block and stamper for swaging.
Vulcanizer and flasks.
Clamps for vulcanite work to prevent raising of the bite.
Bunsen burners for waxing-up cases, and for boiling water. Casting rings, sandbox and sand.
A steam swager.
Petroleum Blast, and furnace for melting the precious metals.
Petroleum Blast, and furnace for continuous gum.

The tooth-clipper (Fig. 7), may be made in the following manner. Take an old worn-out triangular file about 7 inches long, then soften one inch of the end, reduce half that length still smaller so as to leave a shoulder. With the grindstone we now grind out all the file marks, but still keeping its triangular shape. A hole is then drilled in a piece of thick brass so that it will slip on to the end of the clipper and rest against the shoulder. The brass is now filed into circular shape, so as to form a nut. Or an inch of the point of the file may be reduced to about one-eighth of an inch, then made red-hot and bent like fig. 7. A screw about an inch long, the head of which forms a ring, (to be obtained from any ironmonger's), is slipped on to the file, after removing the nut. The latter is then replaced, and rivetted on. A handle is adjusted to the clipper and the edges given a final touch on the oilstone. It is now ready to be screwed into a convenient part of the lathe bench. A piece of sheet lead about three inches long, two and a half wide, and one-eighth thick, is now tacked in a line with the clipper, this is to rest the tooth on to prevent it from slipping.

In order to chip teeth with safety, it is advisable to run a nick or groove in the base of the tooth, with a corundum or carborundum wheel, this limits the amount to be removed.

The model of the stamper (Fig. 8) is made in the following manner.

Mix up a pint basin full of plaster of Paris, and build it up on the plaster bench somewhat to the required form. Now, mix another basin of plaster, and having dipped the model into cold water, place it on the bench again and cover it with a layer of soft plaster about half an inch thick.

After moulding it roughly to the required shape, and before it hardens, it should be covered with a layer of tissue paper, and grasped pretty firmly with the right hand, the tissue paper preventing the plaster from sticking to the fingers.

Indentations in the soft plaster will thus be formed by the fingers and thumb corresponding to those shewn in the figure. A model such as this in cast iron can be obtained from any iron foundry. The object of the indentations is to ensure a firm grip of the stamper while stamping up a plate, so that a good steady blow can be given.

The size of the stamper is at the base $5\frac{1}{2}$ by $4\frac{1}{2}$, and in height $2\frac{1}{2}$ inches.

The model of the block for stamping on, is made of plaster in a similar manner to the stamper. It has a circular space left on its upper surface for the lead counter to fit into, and is grooved, as shewn in Fig. 9. The dimensions are:— height $3\frac{1}{2}$, base $7\frac{3}{4}$ long, by $4\frac{1}{2}$ wide, the top of the block is $7\frac{1}{4}$ inches long, by $3\frac{1}{2}$ wide, the depth of the groove to fit on to the leg is $\frac{3}{4}$ of an inch in the centre.

When using the block the workman should not have his

foot flat on the ground, but raise the heel and let the weight rest on the toes.

Description of the Tools, with an explanation of their several uses.

Shears, straight, and curved, also plate-cutters. These three tools may be grouped together, as they are all used for cutting and trimming up the metal plate after it has been marked out. Curved shears are necessary when one has to follow the curves and indentations of the pattern. The plate-cutters are for cutting out the plate where recesses are to be made for the natural teeth to fit into. By using the shears for this latter purpose, one is apt to make a nick in the plate, which would have either to be filed out or soldered up. This can be avoided by using the plate-cutters, which make a clean, well-defined, half-round cut, at the deepest part of the concavity. It is then only necessary to make two lateral cuts with either the straight or curved shears to meet the half round cut already made, and the piece of metal is removed and the concavity formed.

Small nippers, or cutting pliers, are for trimming up a plate when it is in course of manufacture, or if it is necessary to reduce its size when completed. The object in using them is to avoid the risk of bending or distorting the plate, as would certainly be the case if the shears were used.

When using the nippers, only about one-sixteenth of an inch of the plate is cut at a time, and the student should practice cutting brass, or German silverplate, until he has obtained the necessary dexterity, and can cut the plate without bending it.

No wire should be cut with the nippers above the size used for tube teeth, for thicker wire, larger and more powerful

ones are necessary, or in the absence of such, a nick should be made in the wire with a file.

The same rule holds good for shears, they are quite strong enough for ordinary dental plate, but not for that which requires a heavier strain to cut it. When cutting a plate with the nippers it should be held loosely, and quite close to the part that requires removing.

Pliers, flat-pointed, half-round, wire, and hollow and round.

Flat-pointed pliers are intended for bending or holding small pieces of plate, such as the metal backs of teeth, while being filed.

Half-round pliers are the safest for bending up gold, for clasps ; one jaw being convex, the gold can be bent without being indented by the sharp edge of the pliers, as would be the case if the flat pliers were used.

Wire pliers have a roughened, parallel groove cut in their blades into which the wire is placed, and so held firmly while it is being filed. These pliers are also used for roughening the pins for tube teeth, before they are cemented on. This latter operation must be done with a light hand, or the pin may be twisted off.

Pliers, called "hollow and round" are used by block-makers, but come in very well for dental purposes. One of the blades is perfectly round while a deep concavity is formed in the other. A number of uses can be found for this tool, especially in the making of collars and crowns.

Sculptors are flat or half-round tools used for carving or trimming up the edges of clasps where they join the plate, or the inside of concavities, that cannot be got at with a file.

They are used in vulcanite work for trimming the rubber from around the necks of the teeth.

For these purposes we require two half-round sculptors, large and small, and two flat, large and small, and also a triangular and knife-edged graver.

These should always be kept with a good edge on, if one wishes to avoid cutting one's fingers. It is the blunt instrument that causes an accident ; the reason is, that more force is used than is necessary, and the instrument or tool slips off the object instead of cutting into it.

Besides this, a cleaner and sharper cut can be made, and a better finish obtained than by using a blunt tool.

To learn how to use sculptors properly the student should fit a few bone blocks, and carve some teeth in ivory or bone. This will not only teach him to hold the tool properly so as to keep it under perfect control, but will at the same time educate his hand.

The drill-bow is usually made of either whalebone or cane, preferably the former, it being more pliable and stronger. It should be about fifteen inches long, and the thickness of the point of one's little finger at the butt, or thick end, and should be tapered to half the thickness at the thin end. Two small holes are drilled in the butt about one and a half inches apart, and another hole is drilled in the small end, this end is also notched.

A hank of fine gut (cat-gut) having been obtained from the depôt, or tool-shop, and the end having been passed through one of the holes made in the butt, (it should be the hole furthest from the extremity), a knot is made in it. The knot is then drawn tight up against the bow, and the gut is then carefully bound round it, down to, but not beyond, the first hole. When a length of gut sufficient to last a considerable time has been wound on, the end of the gut is passed

through the hole nearest the butt, and from there it is carried to the thin extremity of the bow. It is then passed through the hole in the end and made secure by one or two knots, the notch previously mentioned preventing any slipping. When the piece of gut is worn out, another supply is unwound and the end made secure again.

The drill-stock, is a steel mandril about three and a half inches long, with a hole either round or square, about half an inch long, made in the extremity, and running parallel with the shaft. Three quarters of an inch from the other end is a pulley around which the gut of the drill-bow works, in order to rotate it; this end is tapered down to a point so as to fit into a small hole in the side of the bench-pin.

The drills to fit the stock are made of soft steel wire, filed to fit the hole in the drill-stock. They should be about one inch and a quarter long; that will leave three quarters of an inch extending from the end of the drill-stock. Of this piece a third should be left round, and of the proper size of wire used ; the other half inch should be first made four-sided, and then reduced to half the thickness. The under surface of the drill should now be slightly smaller than the size of the hole that is intended to be made, the upper surface of the drill should be bevelled away a third of its width, and the extremity, or cutting edge, bevelled from each side until a point is formed.

The drill should now be hardened and tempered, and the bevelled edges of the point sharpened on the oilstone.

A drill shaped like this, clears itself as it goes into the substance, and can be practically used up to the end.

Two or three of these drills should be kept in stock so as to prevent delay in the work should an accident occur.

A chamfering tool for countersinking holes in metal work can be easily made out of an old rat-tail file by breaking the thin point off, and bevelling the end four-sided, until a point is produced. This shaping of the end can be effected on the grindstone, and therefore need not interfere with the temper of the file. This tool should be fixed in a handle, and kept sharp. A similar tool to this is used for countersinking the hole in the base of a tube tooth, to allow for an excess of solder around the pin, where it enters the plate.

Files and rasps. Stub's files are considered amongst the best. They are usually sold without handles, but can be had with flattened end to form a handle if preferred. In the author's opinion the wooden handle is the best; it is more convenient to grasp, and enables one to use the file in a neater and more workmanlike manner. The length of a file is taken from end to end of file cut, and different varieties are known by the names of rough, bastard, second-cut, and smooth. They are called half-round, round or rat-tail, mouse-tail, a smaller edition of the round, square, or triangular. These are metal files, but the first-named can be used for Vulcanite work as well. For roughing down a Vulcanite case rasps are used.

Hand-vice. This is a most useful tool, and comes in for a multitude of purposes; amongst others, holding steel wire for making drills, taps for use with the screw plate, and any small instrument or piece of plate that requires to be held firmly.

A Pin-vice is used for holding wire, up to about No. 4 guage. The jaws are grooved and a hole runs through the whole length of the handle, so that a length of wire can be taken and passed through it, leaving protruding from the

jaws only the piece required. By taking hold of the handle by the thumb and finger the wire can be rotated while being filed, thus enabling one to file it true.

Saw-frame (adjustable) for taking piercing, and fret-saws. These are used for dividing clasps if soldered to the plate, for cutting out a circular piece from the centre of a plate to insert a suction chamber, and for many other purposes. The saws should be so adjusted that they are directed towards the handle, and the saw cuts by pulling it. The saws are not so liable to break if used in this manner.

A metal saw is also of great service for sawing off the teeth of zinc models, and for coarse metal work generally. An old saw is a convenient thing to use when one has to reduce a hard plaster model in thickness.

For other than the precious metals flat and triangular files are used.

Of Hammers, three sizes are required for rivetting, and also for chasing, besides a large-sized hammer for rough work. The rivetting hammer should have a pointed end and a thin, flat, end. The chasing hammer is for use with the punches for chasing around the necks of teeth on the metal model, and the large hammer is for knocking zinc models out from the counter, and for general heavy work.

Broaches are tools about three inches long, about the size of an ordinary knitting needle, and are usually tapered to a point and are five-sided. They are used for opening the hole made by the drill to the proper size.

The Blow-pipe. This is a taper brass tube about ten or twelve inches long, and is obtained either from the depôt or tool shop. It is best to cover the mouth end with a silver

ferrule or a piece of india-rubber tubing, to protect the lips from the action of the brass.

The Bellows blow-pipe (Fletcher's) is a most useful tool, especially for those with weak chests, or who cannot use the ordinary tube blow-pipe. The secret of soldering is to get the case thoroughly heated up over the Bunsen burner before beginning to use the blow-pipe.

The Horn Mallet is used for roughly getting the plate into position. One end is usually too large when obtained from the depôt, and should be filed or sawn to a thin wedge shape.

Tweezers are used for placing small pieces of solder in position on the case and for lifting plates etc., from the soldering block. Tweezers such as those used for dissecting purposes are light and at the same time strong, they are obtained from the depôt or tool-shop.

Arkansas stone is very good for putting an edge on instruments and tools after they are ground. It should always be kept clean, and lubricated with grease that does not thicken or cand.

A steel pointer, for marking holes, can be made from a broken excavator, or from a piece of thick steel wire, filed to a nice fine point, then hardened and tempered ;—it is used to deepen the marks, before using the drill to make the hole for the pin for a tube tooth, and to mark the places in metal when backing teeth, etc.

Steel scrapers for vulcanite work can be made from old metal files by grinding them into the required shape on the grindstone. The files being of an excellent temper it will repay the outlay of time necessary to grind them into shape.

Compasses or dividers come in useful where one wishes to

ascertain the height of an old set that the patient may be wearing.

This is accomplished after one has taken fresh impressions of a patient's mouth, the models are made and the old cases are then placed on them. A mark is then made on the upper and another mark on the lower model, and the width taken by the compasses, this width is then marked on the back of the model and can be used as a reference. The same width is also marked at the sides of the models as well as the front. This gives us a good guide for remaking the set.

The compasses are also useful in ascertaining the width of the jaws, and the amount of movement that may have taken place when regulating teeth.

Calipers are to ascertain the thickness of a case, but are not much used now owing to the introduction of more perfect means of producing a polished plate of an even thickness.

Double-ended wax modeller. This is a very necessary tool, it should be about six inches long and the ends flattened, one end is rounded and the other brought up to a point. It is used for moulding and waxing-up a case. It need not be tempered as it has to be made hot while using.

Small screw-plate and taps. These are used for making screws for split expansion plates, and also for making screw tubes for pivots, etc.

When using the screw plate, the piece of wire that has to be tapped is annealed, then filed four-sided, and slightly tapered at the point. This is to get a better start for the thread of the screw. The wire should not be screwed through the plate direct, but cautiously, that is screwing it backwards and forwards until the desired amount of thread is obtained.

The female thread is produced in the same way, using the tap lubricated with a little oil. The tube to be tapped can be held in the vice if a piece of wire is fitted tightly into one end of it. This prevents the tube from being bent.

For soldering purposes, a slate for borax is required. This may be mounted in lead or Plaster of Paris, to keep it steady on the bench. Borax is used as a flux to cause the solder to flow easier ; it acts by cleaning the surface of the metal it comes into contact with, and so causes the solder to flow over it.

Plate punches (Figs. 10, 11, 12, 13), are used for chasing the plate round the necks of teeth, or into the depressions of deep rugæ.

The handles of broken pliers or nippers, when properly shaped-up make excellent punches for this purpose. They have, of course, to be softened, bent straight, and then tempered. The points should be made to correspond to those shown in the figures.

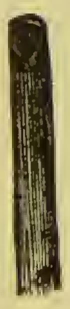


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Larger brass punches are useful to stamp buckles out of plates, and to punch the plate into deep concavities. (Fig. 14).

The Plate-elevator is an instrument used for removing metal plates from the lead counter during the operation of swaging. It can be readily made out of a suitable piece of steel wire, or by softening and filing up an old six-inch rat-tail file.

The end can be given the required curves (see Fig. 15), by

Fig. 14.

bending it when red hot over a thick round rod of iron or steel. The point of the instrument is flattened somewhat on its upper aspect, and at the extreme point a slight notch is made to prevent it from slipping away from the plate, when the latter is being prized or lifted out. It should be hardened and then tempered to a blue colour. A handle can afterwards be fixed to the part that corresponds to the tang of the file.

Fig. 15.

A double-ended brass modeller, (see Fig. 16) is a most useful little tool. It is principally used for moulding up pattern lead, to make the pattern for the plate. It should be about half an inch longer than the illustration.

Common penknife—used for many purposes, such as cutting wax, trimming up models, etc.

Bite frames, for description of which see chapter on bites.

Draw-plate. This is made of steel about three inches long, by one and a half inches wide, and one quarter of an inch thick. It is perforated by a number of holes, ranging say from one to twenty. The holes are enlarged at the back of the plate and tapered up to their proper size as they emerge from the front of the plate.

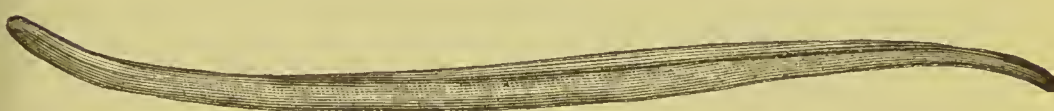


Fig. 16.

The price of these plates varies according to the number of holes and the maker.

To draw gold or other metal into wire, it is necessary to take the ingot of metal and roll it in the flattening mills or rollers, until it is reduced in thickness, this should not be more than a fifth thicker than the wire required. It should then be annealed, viz., made red hot; this is to soften it. It is now ready to cut into strips, these should be cut the same way as the gold was rolled, and the strips should be as nearly square as possible.

The strips of gold are then annealed again and bent quite straight. The end of each should be pointed and the sharp edges taken off with a file.

The draw-plate should be securely fixed in the vice with the front towards one.

The pointed end of the strip of metal is now passed into the back of the largest hole in the plate, and is drawn forwards

through the front by means of a pair of large pliers or draw tongs, (according to the size of the wire).

After the strip has been tightly drawn through three or four holes, it should be annealed again, and so on until the right guage is reached.

In drawing wire, one has to take a firm grip of the pointed end of the strip of plate with the draw tongs, and then throw the whole weight of the body backwards at the same time as the pull takes place. To do this safely it is very necessary to firmly secure the draw plate in the vice, for should it come away one might fall on one's back, or the plate strike one in the face.

The draw-plate after use should be wrapped up in a piece of greased brown paper, and kept in a dry place.

The guage-plate is to ascertain the thickness of plate, and the numbers range from about four to nine. No. 4 is the thinnest and 9 the thickest. Nos. 7, 8, or 9 are the ordinary thicknesses for dental plates, and these plates are in many instances further strengthened by Nos. 5 and 6. For a bar lower plate No. 8 strengthened by No. 7 makes a strong plate and admits of the edge being nicely rounded, and strength given to the pins of tube teeth. The Messrs. Ash supply a set of brass standards of the different thicknesses of plate, which are most useful as a guide.

The Vulcanizer. The one great element to consider in a vulcanizer is that of safety, and for this reason one with the boiler made of gun metal is to be preferred to one made of cast iron. Another feature is that it shall be easy of adjustment, and there is no question but that the arm with centre screw presents the simplest and most effective form for fastening on the lid. If the edge of the lid is grooved so as

to fit on to a corresponding ridge on the rim of the boiler, a very effective and lasting steam joint can be made by filling the groove with lead ; this does away entirely with the old rubber washers, which were always a source of trouble and annoyance, and constantly getting out of order when subjected to the not always gentle treatment they experienced in the laboratory.

Another essential is that the vulcanizer should be supplied with a pressure-guage and gas-regulator ; this is a great element of safety, especially in the workroom where pupils or young people are employed.

An even temperature is maintained, no matter how long the vulcanizer is left, and this is more conducive to producing a tough strong case, than when the temperature is constantly fluctuating as it would be if the boiler was not supplied with a gas-regulator.

The vulcanizer should be supplied with a Bunsen burner for heating, and each time the boiler is used it should be cleaned out. A fusible plug in the lid of the vulcanizer further minimises any risk of an accident.

Vulcanizers combining these essentials and elements of safety can be obtained at the principal dental depots, and the advice the writer would give to the young dentist about to purchase one, is to get the very best that can be bought.

Flasks are made of gun metal or iron ; those of the first named metal are the best, they are cleanest to work with, and do not rust.

For all practical purposes a flask divided into two sections and a lid is all that is necessary. The flasks should be cleaned from plaster after using, and the edges between kept

perfect. Perfect closure of the two halves of the flask indicates that the bite is not raised in edentulous cases.

It is a very common, but reprehensible practice to hammer the edges of the flask for the purpose of removing the plaster after using ; such should not on any account be done, a stiff-bladed narrow knife should be used to cut deeply into the plaster around the circumference of the flask, the point of the knife being directed to the side. If this is done on each side of section, the plaster and case are easily pushed out without any force.

A clamp for preventing the bite from being raised either in partial or edentulous cases is shewn in the section on vulcanite work, and the manner of using it described.

The clamp is made in the following manner :—Take a strip of brass plate, No. 9 guage, about four inches long, by two inches wide. Now draw lines half an inch from the upper and lower borders. The brass plate is now placed in the vice, just allowing the half inch line to be seen, this is then bent at right angles. The brass is then reversed and the other border served in the same way. Sections are now cut from the bent portion, to enable the clamp to be bent so as to conform to the shape of a model. These clamps may be made in several sizes so as to accommodate different sizes of models.

This form of clamp was devised by the writer's father, and has been in use over twenty years. It effectually prevents any raising of the bite, and presents the case in a most convenient form for packing in the rubber. In cases where there is a difficulty in introducing the rubber, such as presented by a case in which the teeth fit pretty closely on the model, and there is a considerable substance of rubber along the outside of the

alveolar border, it is the best plan to remove the teeth, and pack the part that is difficult of access, then replace the teeth and finish the process.

A Press for squeezing flasks together after packing in the rubber, will be found a useful adjunct to the plaster bench. It will save the vice from being used for this purpose.

Bunsen burners, for waxing up cases, for boiling water, heating-up plate-work prior to soldering, and other purposes, may be seen in great variety in any dental catalogue. For modelling-up a case in wax, the burner should give a blue flame, about the size of that produced by a spirit lamp, while the Bunsen for heating purposes, is brought to great perfection by Mr. Fletcher of Warrington, giving an intense heat without smoke.

The Steam Swager. This has been described and illustrated in the section on Vulcanite Work. It is a most valuable adjunct to the dental laboratory, as it enables the dentist to realize an ideal in the making of rubber dentures, that before its introduction was simply impossible. By its use a perfect contour plate can be produced of any thickness, perfectly copying the depressions and elevations of the palate, at the same time the surface is brought out polished.

Wire Clamps for holding strengtheners in position on a gold plate, are made out of soft iron wire in the following manner:—Cut the wire into two inch lengths, flatten half an inch at each end, then bend the centre portion into a circle as near as possible, and make the two flattened ends, approximate to each other along their whole length. A stock of these clamps can be made in half an hour, from different thicknesses of wire, and will be found useful for many purposes.

The Grindstone should be from a foot to eighteen inches in diameter, and fixed on a suitable iron stand, forming the trough in which the stone runs, and containing the water to moisten it. The most convenient form of grindstone is one to which a treadle is attached so that it can be worked by the foot. A great deal of time is saved in sharpening tools by having a good sized stone. Besides sharpening tools, it is also very useful, in reducing into shape old files to make scrapers for vulcanite work. This can be done without in any degree reducing the temper of the metal. First-rate scrapers can be made in this way, the file being finely tempered and of the best quality of steel.

The attention of the reader is now drawn to the tools and appliances that are absolutely necessary if the young dentist desires to go abroad, and then has to depend upon his own skill, ability and ingenuity, to supply himself with materials, etc., that he would otherwise have to send to a depôt for.

In such a case he will have to provide himself with a pair of flattening mills for rolling gold, iron ingots of various sizes to pour gold into when melted, crucibles for melting, and tongs for placing them in and withdrawing from the fire.

A pair of extra large shears for cutting plate thick enough for wire, and a draw-bench, a large pair of draw-tongs, and large pliers for pulling wire.

A complete set of carpenter's tools will also be found a useful addition to his *répertoire.*

He should also provide himself with the means of making springs, and lay in a stock of steel wire of various degrees of thickness, also cast steel plate that he may not be at a loss for

various little tools, that he should have been taught to make during his apprenticeship.

Now, as it is part of a dentist's education to understand the use of the tools named, so also it is essential that in the event of accidents happening, he should be able either to repair or renew the same. To attempt this the dentist should know how to forge, file, harden and temper steel.

To make an instrument, the steel unless already soft, should first of all be made red-hot on a block of charcoal, and allowed to cool very slowly. This treatment makes it quite soft, and enables one to file it readily.

If it be necessary to flatten or forge it to any desired shape, it should be placed in a fire, preferably one of charcoal, and brought up to a red heat, and while in that condition, should be hammered, bent or flattened, according to the desired pattern.

If all the forging can be done during the first heating, it is better, as less carbon is taken out of the steel, but on no account must it be hammered when cold, that is to say when the redness has gone. It should now be allowed to cool slowly, avoiding contact with any cold surface, as it is likely to harden it somewhat.

The after treatment of the forged metal, is to file it into its proper shape, then with a fine file to produce a smooth and finished surface free from cuts or scratches. It should now be smeared over with soap and made red-hot again, and then suddenly plunged into cold water or oil. It is now so hard that a file would not make any impression on it, and also so brittle that great care has to be taken, that it does not get broken.

The object of rubbing soap on it prior to making it red

hot, is that the soap prevents the surface of the steel from oxidising or scaling.

The instrument, or at least that part of it that requires tempering, should now have the surface cleaned sufficiently to enable one to see the colour of the steel, while changing under the influence of heat. Small things may be tempered by holding them over the flame of a Bunsen burner or spirit lamp, or if the article to be tempered is thin, like a spring, or clamp for instance, it may be tempered by placing it on a piece of iron, made nearly red hot, this will bring out the colour gradually and evenly.

When the colour is discernable the instrument should be immediately dipped into cold water or oil.

The following formula for tempeiing steel is taken from Fletcher's Dental Metallurgy :—

	Fahrenheit	Centigrade
Light straw-colour	430°	221°
Dark straw-colour	470°	243°

The above for wood, ivory, and vulcanite tools.

Brown-yellow	500°	260°

For gravers, and tools for metal cutting.

Bright blue	550°	288°

For springs and saws.

It is the best plan to heat first the part of the instrument that does not require any accurate temper, such as the handle or part furthest away from the cutting edge. When this has been reduced to a blue, the other part of the instrument is passed to and fro in the flame, taking notice at the same time that the thinner portion of the instrument should be the last to apply the heat to.

After tempering, the instrument may be polished by rub-

bing the surface with corundum or carborundum files or wheels, and finishing off with emery and oil.

For filing steel, or iron, or brass, suitable files should be used ; on no account should the files one uses for gold work be applied to this purpose.

For forging steel, one wants a strong beak iron, and a fairly heavy hammer. It is not supposed that one would attempt anything very large, as such would require a beak-iron and hammer, heavy in proportion.

THE USE OF TOOLS.

Nothing more conclusively shows the difference between a good experienced workman and a novice, than the manner in which he uses tools and other appliances, in the dental, as well as any other workroom. Not only is this apparent in the handling of the same while doing his work, but is also in a more marked degree shown by his improper selection of tools for purposes they are not intended for.

The rougher portions of our work will here be referred to more particularly, the writer having found, from experience of student life, that it is in this section that one has to look for the most damage. For example, in drawing wire, instead of using a pair of draw-tongs, a small pair of pliers is taken, a strain is put on the handles greater than they are intended to bear, and as a consequence one of the blades snap off. Again, a small pair of nippers, sufficiently strong for cutting ordinary dental plate, is used to cut something three times as thick, perhaps a tooth on a zinc model. What is the conse-

quence? A fracture. Another instance occurs while drawing wire; it is not dried after annealing, or the draw plate is put in a damp place, and not properly oiled after use; it thus becomes rusty and inaccurate. Again, while rolling gold, the ingot of metal is not cleaned from flux, or is not dry; as a consequence, a valuable set of rollers is spoilt in a very short time.

Tempered broaches are used as if they would bear any strain and are frequently broken the first time of using.

These are some of the abuses of the use of tools, and all of them could be avoided, if one were only to think for a moment that if great force is to be employed it requires a strong instrument, or tool, in proportion. Accidents will happen sometimes, but with a little care and thought, such as have been named can be avoided.

The tools and appliances in the laboratory should be kept in a state of efficiency. New saws in frames when required, sculptors sharp, and drills in good condition. All these matters should be attended to directly work is slack, or there is idle time; by these means, when busy again, one is able to go on with the work with comfort and despatch.

In conclusion, it should be mentioned that all tools, lathes, and appliances requiring it, should be kept clean, bright and well oiled, either with vaseline or goose-grease; both these being lubricants that do not thicken or get sticky.

To clean lathes, etc., when dirty, they should be rubbed with paraffin oil.

WORKROOM ECONOMY.

To study economy while doing his work is one of the earliest principles that should be instilled into the mind of the young beginner, and he should be taught to so habituate himself to carry out the necessary details, that in time it becomes natural to him to do so without an effort.

Foremost among the many channels of waste in the dental workroom is the gold drawer ; this should be provided with a hare's-foot or a large badger-hair tooth brush, that being much softer than the ordinary ones.

When gold is being filed, the drawer should be kept wide open, so that, if a rough file is being used, the small particles of gold do not fly over the edges of the drawer.

Now the drawer cannot be kept properly open if the workman sits too close to his bench-pin, therefore this part of his education should not be neglected. Again, too great stress cannot be laid on the fact, that the gold drawer is not the place for tools of any kind.

If files are used a slight tap on the bench-pin will detach any loose filings that may be adherent to them, and then they should be placed on the bench in front of, or at the right side of the workman.

Should they be put in the gold drawer particles of gold attach themselves to the handles, after they have been in the warm hand, and if they are not brushed clean each time, before using again, (which in itself is a waste of time) considerable losses of gold will take place.

Drills and broaches should be passed through the brush

also, and all work after filing, as well as the bench-pin should be brushed before placing the case on the model again.

By attending to these apparently small matters, a considerable saving will take place in the course of a twelvemonth. With all one's care it is impossible to avoid some waste, but one can account for a large percentage of it, by carefully saving all the dust that collects on the bench, the dirt off the floor, the old rags that one uses for wiping cases, all the sediment that collects in the water-troughs of the lathes, and all the washings of the hands after polishing cases. All these small matters may be overlooked by the inexperienced beginner, and thrown away. The author does not advocate keeping these "sweeps," as they are called, separate, as it entails much extra work, which in the long run does not pay. When a sufficient quantity, say a good-sized barrel full, has been collected, it should be sold to some respectable refiner. To obtain information on this point, it is as well to consult some old dental friend. The author's experience is that refiners are not all alike, in the way they treat their customers. A notable example of this was brought under the writer's notice quite recently. It was a case in which for six or seven years the average for the floor "sweep" did not amount to a pound per annum. On the recommendation of a friend, a new refiner was tried with the result that a cheque for nearly eight times the former amount was received. Taking into consideration that the average of work was about the same, one must naturally conclude that there must have been something wrong somewhere.

Another important consideration is in the consumption of gas, for one may find it flaring away, not only before, but long after it has served its purpose ; this not only represents

a money loss, but it also tends to vitiate the surrounding atmosphere, and is detrimental to health.

Again, one might mention the waste that takes place with use of plaster of Paris. This might be avoided if one noticed the amount of plaster necessary for each operation ; in a very short time a fairly accurate idea would be gained of the amount required, and much waste would be avoided.

Now we arrive at another important item, and that is, a loss of time.

Speaking of this, we do not wish it to be understood, that we would curtail the time necessary to do the work effectively and well, but on the contrary, would allow the maximum time if it ensured the work being more perfect. But a great amount of time is lost, especially with the young beginner, in not rectifying an error at once. For instance, if a clasp does not please us by its fit or shape, or if the position of a pin, for a tube tooth, does not seem to us quite as it should be, it is quite as well to get into the habit of altering it at once, than by thinking over it, and so lose more time than it would take to make the necessary alteration two or three times over.

Then again, the workman should always "be doing." If he is waiting for the plate to clean, or the case to cool, he can be going on with the clasps, backing the teeth, or putting his tools into an efficient condition. This is the great secret of rapid working.

While we would advocate diligence in the work, we would at the same time point out that it is not the noisy workman who gets through the most work. Noise is a thing that should on every occasion be avoided. Much noise may be prevented when any hammering has to be done on the bench,

by resting the anvil, or block, upon a bag of sand or a thick layer of rags. Swaging up the plate with the model resting on the bench should be considered a gratuitous annoyance to everyone in the workroom, and is to be condemned, considering how easy it is to avoid it.

The uses of the Dental Engine, in the Laboratory :—

The importance of this appliance in the workroom cannot be over-estimated, and if used in a careful and intelligent manner, it will last a considerable time without getting out of order.

For fine-fitting tube teeth to a plate, for letting down a crown or pivot tooth on to a root, for such fine operations as fitting porcelain facing to bicuspid [crowns, it has no equal; the minute wheels, cones and sticks of carborundum which can be used with it, enable one to produce the most perfect results.

Again, for repairing split vulcanite cases, after making a little plaster model of the palate of the case, a fissure bur in the engine can be used to produce a new clean surface to the edges of the fissure, by first of all running the bur through the plate and drawing it from one end of the split to the other, after which lateral cuts can be made on each side for the further strengthening of the new rubber.

For hollowing out spaces in a rubber plate for the introduction of a strengthener, for easing cases over roots; for removing the drags on rubber cases corresponding to the necks of the teeth, a large rose bur is most suitable and does the work neatly and well.

For removing a tooth or gum block from a case, a small bur can be used to work around the pins and remove the block without damage to the case.

For polishing the inside of gold plates, clasps, and round about the backs of the teeth, also in the indentations of the rugæ, the engine can be employed with effect, as the extremely small appliances used with it can be introduced into the most constricted space.

One is also enabled to mount a small circular saw, which can be used as well as a wheel for removing a metal back from a plate.

These are a few examples of the uses the engine can be put to, and for which it is especially adapted.

To make the little chucks to carry the small wheels, &c., a piece of round polished steel wire is obtained the same thickness as an engine bur. The wire is nicked deeply at suitable lengths with a file, and snapped off, and then the ends are filed smooth.

These pieces are held very firmly in a Hodge handpiece.

We now take some German silver tube that will just fit the wire. Cut the tube into lengths, of an inch long, and file each end level. We must next slip one of these tubes on to the wire, leaving the end protruding about one-eighth of an inch. We solder the tube to the wire with silver solder. By this means a shoulder is formed for the wheel to rest against.

A porte-polisher for carrying points of corundum, or carborundum, can also be very simply made, by soldering a tube on to the steel wire, letting the end of the tube project about half to three quarters of an inch. This projecting portion can be tapered a little and split. To fix the carborundum point, melt a little shellac into the tube, then make the carborundum point hot, and press it into the melted shellac.

THE MATERIALS USED IN THE DENTAL LABORATORY.

These may be grouped in the following order.

For moulding in sand.

Sand, or loam,
Pumice, Brickdust,
French chalk,
Lycopodium,
and Common Resin.

This latter is used to give a carbon surface to a sand or other cast. A stick of ordinary firewood is taken and either dipped into melted resin, or the resin is melted over a flame and dropped on to the wood. It is then set alight, and holding the sand mould over the smoke of the resin, the surface of the sand is coated with a black deposit in a few moments. By coating the sand or other mould in this manner a better surface is obtained to the resulting model.

For polishing purposes.

Pumice, rouge, whitening, water-of-Ayr stone, sandpaper—and for polishing steel, emery and oil.

The art of polishing, is to produce first of all a perfectly smooth surface, free from scratches and irregularities. This should be accomplished with the sculptor and smooth file. Afterwards sand paper and water-of-Ayr stone must be used. A good surface should be put on a case before it is taken to the lathe, so that only a moderate amount of rubbing with pumice and oil (if a gold plate), or pumice and water (if a vulcanite plate), need be used, and the final finish may be given with rouge, or whitening and water.

For modelling purposes.

Beeswax, yellow and white, paraffin, resin, and, as a colouring matter for the wax, carmine.

The *coarse metals* in general use *for casting purposes* are :—

Lead, zinc, tin, type metal, fusible metal, meter metal, and Sullivan's cement.

Sullivan's cement may be prepared in the following manner :—

Make a saturated solution of sulphate of copper in boiling water. Then place in the solution several pieces of sheet zinc. The copper will be immediately precipitated. Pour off the water and wash the precipitate several times in weak sulphuric acid ; this will dissolve out all the zinc. Now add to the copper precipitate a sufficient quantity of mercury to amalgamate with, and form it into a stiff paste. The surplus mercury is expressed from the mass, by squeezing in a piece of chamois leather. It should now be moulded into small pellets and allowed to harden.

Sullivan's cement comes in for many useful purposes, such as making models for crowns, or unwearable teeth for plaster models. If used for these purposes, it should be softened and pressed into the cavities representing the teeth in the impression. The impression is then filled up with plaster of Paris and allowed at least eight hours to harden, before it is placed in hot water to remove the composition. We shall thus have a plaster model with teeth of Sullivan's cement.

Materials for models.

Plaster of Paris of the finest quality should be used for this purpose, this is known as "superfine." For other

purposes than models, a lower grade of plaster may be used.

To prepare a plaster model for a gold plate, it should be carefully, that is slowly dried, and then while still warm placed in hot melted stearine, or in melted wax and resin, or it may be varnished with methylated brown spirit varnish. The object of thus preparing it, is to harden the model so that it is less liable to be rubbed during the swaging of the plate, and fitting of the clasps, and it also makes the model nicer to handle.

Materials used as a *parting medium* between

1st. Two surfaces of composition. Vaseline, French chalk, or soap.

2nd. Between two surfaces of wet plaster. Soap, or vaseline, preferably the former.

3rd. Between hard rubber and a plaster surface. French chalk, silicate of soda; thick tin foil, or meter metal, or before the rubber is vulcanized, French chalk or a piece of linen. This latter should be dipped in hot water before applying it.

Acids used for *cleaning plates.*

For gold, hydrochloric acid.

For silver and dental alloy, sulphuric acid.

These may be used slightly diluted, and kept in an ordinary gallipot fitted with a cover. When it is found necessary to boil the case out in sulphuric acid a copper dish may be used for that purpose, and the fumes of the acid allowed to escape up the chimney.

Materials used as a flux for soldering purposes.

Borax for Gold, Silver, Platinum, Dental Alloy, Copper and Brass. Zinc chloride for Tin, Lead, Zinc, or Pewter.

Chemicals used for *collecting and purifying* gold filings, Potassium Carbonate, Potassium Nitrate, Sodium chloride,

Hydrargyrum bichloride. When the filings are collected into a button, this should be remelted with borax.

Materials for taking Impressions of the Mouth, and their Relative Values.

Beeswax. The product of the honey bee, melted down, freed from impurities, and cast into a mould.

To prepare it for dental purposes it should be remelted in a vessel suspended in boiling water, and then poured into a plaster of Paris mould, previously damped. This is to form it into thin sheets, and the object of so doing is that the wax may be readily softened without using the water too hot. White wax is the above, after undergoing a process of bleaching.

Plaster of Paris. This is the name given to Gypsum when ground and used for taking casts. Gypsum is an exceedingly abundant substance,and is met with in a great variety of forms. When in a crystallized condition it forms prisms of great transparency and symmetry, and in this state it is called Selenite. The crystals are sometimes massed together in bundles, or radiate from a centre, and a variety of this from its lustre is called Satin Spar. When in uniform, saccaroidal, translucent masses it constitutes Alabaster, and it is found besides in large beds or rock deposits, constituting ordinary gypsum.

The appearance of the different species of this substance varies greatly, the purer kinds are translucent, or transparent, with hardly any colour, the commoner kinds are opaque, and the colour varies from white and pale yellow, through red to brown, and black and blue gypsum are also known.

When heated, water is expelled from the gypsum, but if the temperature has not been too high, it retains the power of recombining with it, but if heated to a high temperature it passes into the state of anhydrite.

Gypsum in large quantity is usually met with in the salt and coal deposits, but it occurs in beds in large aggregations, and in thin seams and fibres in all kinds of rocks. One of the most important is the deposit at Montmartre, Paris, but it occurs abundantly in this country, and in other parts of Europe and America.

After the gypsum has been calcined and ground, if mixed with water to the consistence of thick cream, it hardens in a short time and acquires great solidity ; during the process of consolidating it expands in consequence of the absorption of the water by the particles of plaster.

There are several grades or qualities of plaster made known as coarse, fine, superfine, and extra superfine. The two best should be used for our work. To ensure a hard model, the plaster should not be mixed with an excess of water. The thicker the plaster is mixed, consistently with its thorough incorporation with the water, the harder the resulting model. The plaster hardens more rapidly with hot water than with cold.

The addition of borax or alum makes a model that is considerably harder than the plain plaster, but it is not desirable to add these materials where the cast has to be used for vulcanite work.

Gutta-Percha. When quite pure Gutta Percha is of a greyish white colour, but that sold commercially is usually of a yellowish or reddish-brown colour. It is the concrete juice of a tree called the Isonandra Gutta, and is found in the

forests of Malay, Sumatra, Borneo, and adjoining islands.

It was formerly obtained by cutting down the tree, but it is now procured by surrounding the trunk of the tree with a ring of clay with elevated edges, to form a receptacle. An incision is then made above in the bark, and the milky juice at once exudes, and is collected in the clay reservoir. This juice by evaporation yields a pellicle which forms on the surface like cream does on milk, and the pellicle is renewed after removal.

These strata laid one upon the other form layers of greater or less thickness, and constitute the crude article of commerce.

Gutta Percha is used for a number of purposes in dentistry. In its perfectly pure state such as we find in Truman's gutta percha, it may be used as a lining for dental plates, when we have a patient with extremely tender gums.

It is also prepared at the depôts for taking impressions of the mouth, and is then incorporated with some such material as oxide of zinc or magnesia, and a pinkish colour given by vermilion.

It forms also the principal ingredient in various filling materials.

The Compositions.—These materials, although in extensive use among dentists, are to all intents and purposes "trade secrets," therefore their ingredients and proportions can only be surmised by the uninitiated. However, one may perhaps say that French chalk, stearine, and gum Dammar or Kowrie play an important part in their manufacture.

Before drawing the reader's attention to the relative value of impression compounds, it is as well that we should have some idea of the kind of material necessary to fulfil our

requirements, not only with satisfaction to ourselves but also to the patient's comfort.

Firstly,—It should soften at a fairly low temperature, and harden rapidly in the mouth, so that the chances of dragging, or displacement, are reduced to a minimum, or avoided altogether.

Secondly,—It should have a putty-like consistence, free from elasticity, and should adhere or stay to the place it is pressed against, and accurately copy any surface.

Thirdly,—It is desirable also that it should be of an agreeable colour and taste.

Fourthly,—That it should contract rather than expand during the process of hardening, so that a clearer and better impression is obtained.

The above qualifications will meet the description of the material we want, and the nearest approach to it that the author has found is the composition known as A 1.

The following table will guide us in our estimate of the materials mentioned for taking impressions of the mouth.

	Time takes to harden.
Plaster of Paris, mixed with cold water	5 minutes.
Ditto mixed with warm water	4½ „
Gutta Percha . . .	8 „
Stent's Composition . .	4 „
A 1 ditto . . .	4 „

It will thus be seen that Stent's and the A 1 Composition come out best in point of saving of time. The A 1 has the advantage that it is not so elastic as Stent's, and has not the slightest tendency to roll. It does not, however, present so pleasing an appearance as Stent's, but that is a quality that

can be dispensed with ; it likewise softens at a very low temperature and appears to contract on cooling.

This latter quality can be readily demonstrated by taking an impression of one's own mouth, as when the Composition begins to harden it seems to grip the gums more and more forcibly until it has quite solidified.

Since writing the above, the number of the Compositions presented to our notice has considerably increased, and in order to make a selection of an impression compound we must be guided by the manner in which it fulfils the requirements previously mentioned.

How to use Beeswax.

Take a sufficiency of the wax in thin sheets, and soften in water at a temperature of 150° Fahr., or just enough to bear one's fingers in. When soft it should be kneaded free from lumps and formed into a roll. The impression tray having been previously heated by placing it in the hot water, the roll of wax is pressed into it and adheres to it firmly. It is now ready to take the impression of the mouth. Those who have had any experience in the use of wax, and have worked to the models obtained by its means, must have discovered that the plates made to such models, though fitting the same accurately, yet when placed in the mouth, stand away, or do not lie close to the palate.

What is the cause of this ? It is that soft wax has a tendency to roll away from the place it is pressed against, and this rolling away cannot be properly controlled unless the impression tray fits the mouth with such accuracy that the

wax is as it were imprisoned and is thus prevented from exud ing while it is under pressure. Again, wax does not get sufficiently hard in the mouth to allow of its withdrawal without dragging.

In edentulous mouths, more especially in the upper jaw, this dragging is fatal to the correctness of the model, for in such cases the wax adheres so very firmly to the palate and gums, that on exerting force to part it, the impression is drawn out of shape, and of course its value as such is lost. Many devices have been suggested for overcoming this dragging, such as having trays perforated, through which the wax might be pierced, in order to allow air to get in between the wax and the palate, and thus facilitate its easy withdrawal; but in most cases this has proved far from satisfactory. One might safely affirm that is almost impossible to get two wax impressions exactly alike. If wax is used the impression tray should approximate as closely as possible to the mouth.

When taking an impression of a mouth in which natural teeth are present, the wax should be pressed against the teeth in order to get as accurate a copy as possible of such teeth, and notice must also be taken of the slant of the same in order to withdraw the impression with the least amount of resistance.

The only operation in the mouth that one would recommend wax for, is the taking of temporary impressions, and only because it is the least objectionable material to introduce into the oral cavity.

Plaster of Paris.

We must now give a more extended consideration to the material above named, because by many dentists it is believed to be the only material that should be used for this important

operation, and with which alone a perfect impression can be obtained. Now, what is meant by a perfect impression may be misconstrued ; we may have a perfect impression, and still have a bad, or in other words, a loose fit. When plaster is inserted in a tray, and pressed into its place in the mouth, being soft, it exercises no amount of pressure on the gums and soft tissues, but copies both without displacing them. When hard and plaster is cast into it, a foreign body in the shape of soap is introduced between the impression and the subsequent model, tending to destroy the sharpness of line of any irregularities of surface ; and one has in the subsequent model what appears to be a slight enlargement, making, when the case is finished, a loose fit.

To illustrate better what is meant the author would mention the case of a patient who, at the time of her visit, was wearing a vulcanite upper and complained of its being loose and falling down. When an impression of her mouth was taken in A 1 composition she stated that the previous impression was taken with Plaster of Paris. A new case was made for her, and it fitted her mouth far better in every respect, than the case she had been wearing, and which had only been made a few weeks, and which appeared (with the exception of its looseness) a perfect, well-made piece of work.

He could only account for it in the following manner, firstly, sufficient pressure was not brought to bear on the gums and the soft tissues adjacent, so that secondly the resulting size of the plaster model caused the further mischief.

On the other hand, the composition contracted in of the process hardening, thereby clasping the gums and exerting pressure on them; at the same time, in forcing it

into place, more pressure was required than with plaster, thus overcoming the elasticity of the soft tissues for the time being, and producing a more reliable, we will not say a more perfect cast, than was obtained by the plaster.

We will now proceed to explain the method of taking a plaster impression.

To perform this operation neatly, a temporary impression of the mouth should be taken in wax, and a plaster cast made. After removing the wax in hot water, and trimming the model up, a zinc model and lead counter should now be obtained, (see chapter on Casting in Metals), and a German silver or pewter tray swaged up. Or a more rapid method is by blowing up two sheets of meter metal in the steam swager. It is as well to cover the plaster model with a sheet of wax in order to make the swaged impression tray rather larger than the plain model, and capable of containing about one-eighth of an inch of plaster, spread over the surface.

The tray when finished, should be coated with a thin film of wax which may be melted on it, and to the posterior edge of wax a few shreds of wool may be tacked to the wax. The plaster is then mixed with water to the consistence of thick batter, and then spread over the surface of the tray, and incorporated with the wool at the back. This latter prevents any surplus plaster from falling into the mouth. The plaster should however, not be in a condition to flow when introduced into the oral cavity.

Before the introduction of a tray, the patient should be asked to gargle the mouth with warm water. It is now pressed up into its place, taking the same precautions as to drawing the cheeks out of the way, as with other materials, and it is kept firmly in its place until quite hard. This can

be ascertained by testing the remaining plaster left in the basin.

For taking impressions of the mouth, when there are natural teeth standing, other and more complicated means must be adopted, but for this purpose we certainly do not think that plaster is the proper material to use, especially if we have to take it away in sections, and make a puzzle of it, before it can be put together again.

The great objection to plaster, besides what has been mentioned, is its disagreeable taste, the length of time it takes to harden, and also that undercuts cannot be taken with it, unless it is brought away in sections.

The non-exertion of pressure on the gums is its greatest advantage when an impression of a cleft palate, or other model, is to be obtained, and when the soft tissues are not to be displaced.

Gutta Percha.

When using this material it should be softened in warm water, and kneaded into a roll; the tray is then warmed and the Gutta Percha placed in it and made smooth on the surface, it should then be carefully inserted into the mouth, and when pressed home, a jet of cold water or cold air should be directed on it to expedite its hardening. In the author's opinion the present material that we possess is not a reliable article, and will require considerable improvement before it appoaches in value to any of the other compositions for taking a correct cast of the mouth. It takes longer to harden than plaster of Paris, and unless it is quite hard has the same tendency to drag as wax, and also possesses the same tendency to roll

away from the place it is pressed against. It is, however used by some practitioners and spoken very highly of.

Composition.

It should be softened in warm water, heated to about 165° Fahr., or rather warmer than one can bear the fingers in comfortably; on no account should it be placed in water too hot, for that spoils its qualities. When kneaded free from lumps it is formed into a roll and placed in the impression tray, which has been warmed by dipping it into the hot water. It should now be passed to and fro over a spirit lamp in order to further soften the surface, and if there are teeth present in the mouth, a slight quantity of vaseline or soap may be smeared with the fingers over the heated surface, this serves as a lubricant and allows of its easier withdrawal from the mouth. It is now ready for use, and when the tray is pressed into its place, should be held firmly until it is quite hard, when one may test the fitness of the case for suction work, by the amount of resistance met with in attempting to withdraw the tray.

TAKING IMPRESSIONS OF THE MOUTH.

The term impression is applied to the result of an operation, by which one obtains an inverted representation of the mouth and teeth in some soft material, such as wax, plaster, or composition.

The term model or cast will be used to mean a fac-simile of the mouth, obtained by pouring plaster of Paris which has been mixed with water into the impression and owed to harden.

The advantage of having a correct model of the mouth to work to, is so obvious that one need offer no apology for dwelling on this subject at some length.

It is not everyone who is cognisant of the difficulties one meets with even in this preliminary operation, but that they are frequently brought home to us in a very practical manner, no dentist of average experience will attempt to deny.

The nervousness of some patients, the fastidiousness of others, and the stupidity of many more, is often the cause of a bad impression, and, as a sequence, an artificial plate that does not fit the mouth.

To overcome the objection of one's patients to this operation, it is incumbent to explain to them what one wants them to do. Above all, let them understand that the success of the future case depends upon them giving you every assistance in this important undertaking, by keeping the mouth wide open, by remaining perfectly still and not attempting to talk, and by attending to your advice should they feel nausea, to draw in the breath deeply, in order to get the Soft Palate out of the way.

In taking the impression, one must be guided by certain rules, which are as necessary for the patient's comfort as for the success of the operation.

In the first place the impression tray should approximate in size and shape to the jaw for which it is intended. It should be slightly larger but still following the same outline, so as to admit of sufficient but not an overplus of the modelling compound. By following the curves or contour of the jaws it approaches more to a cup shape, thereby imprisoning the material used for the impression, and thus preventing its

flowing or oozing away from the part against which it is pressed, and so ensuring a better and sharper impression.

Another consideration one must bear in mind, is to use as small an amount of composition, or plaster, as possible ; it allows of the tray being more readily tolorated. An excess of material, or a clumsy tray, especially in the mouth of a nervous or restless patient, is sure to be fatal to the success of the operation, nor is it to be wondered at, for the process is a most disagreeable one.

I would strongly advise every student to take one or two impressions of his own mouth, using an ordinary impression tray, and when he finds the material oozing out at the back part of the tray and slowly making its way along the soft

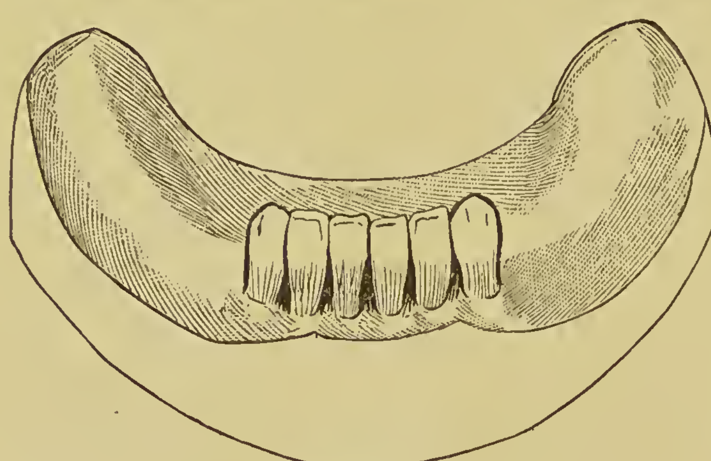


Fig. 17.

palate and so into the pharynx, he will, after the four minutes which it usually takes to harden, have gained much experience ; and I am perfectly sure, at the same time will have firmly established in his mind a large amount of sympathy for any of his patients who have to submit to the same ordeal.

One cause of failure in taking impressions is the common idea that it is necessary to have a model of both the labial and lingual aspects of the teeth; this in the majority of cases is not required.

Let us see how this affects the impression, and in the first place it will be as well to observe the shapes of the teeth, especially in those cases where absorption of the gum has taken place and these are long and straggling (see Fig. 17).

They will be found to present a series of cones with the broad ends represented by the points of the teeth. Now, when the impression compound moulds itself around the narrow necks of these teeth and hardens, one of two things must take place, either the teeth will be drawn out by the compound, or the material itself will be dragged out of shape.

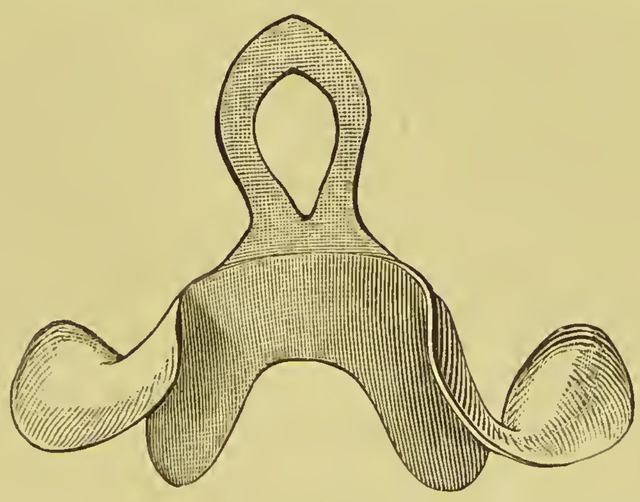


Fig. 18.

The latter, of course, is generally the case. Suppose, instead of having the tray to fit both sides of the teeth, we so adjust it that the lingual aspect only is taken (see Fig. 18), it gives one a much greater chance of getting a satisfactory impression being much more readily removed from the mouth.

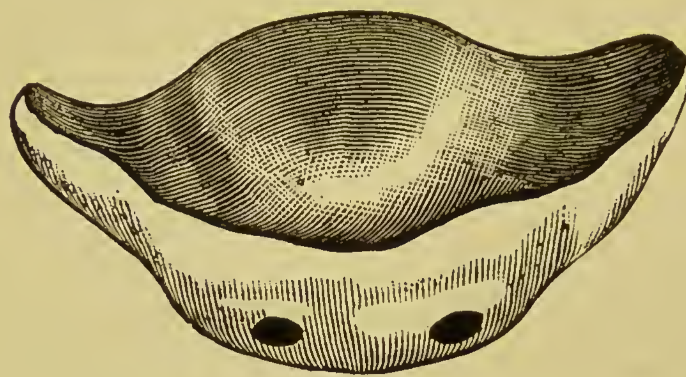


Fig. 19.

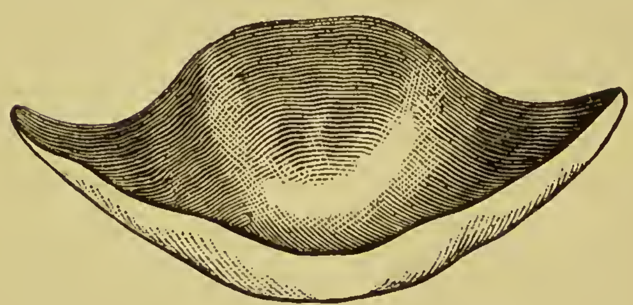


Fig. 20

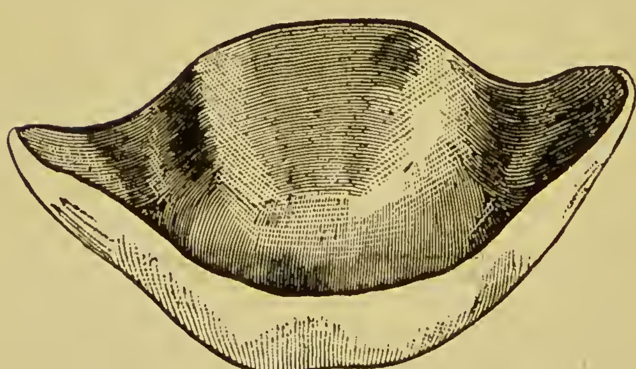


Fig. 21.

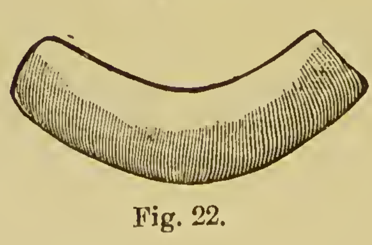


Fig. 22.

One of our greatest troubles hitherto has been the length of time that it has been found necessary to keep the composition in the mouth, in order to insure its being sufficiently hard to withdraw, without fear of dragging it out of shape. This difficulty can now be overcome in a most satisfactory manner by using what is known as an irrigated tray. That is, a hollow tray of German silver, through which a current of cold water is made to pass. Figs. 19 to 23 show the various parts of such a tray.

Fig. 19 represents the outside plate.

Fig. 20 the middle or intermediate piece, which may be either made of tin, German silver, or meter metal.

Fig. 21 represents the inner portion.

Fig. 22 is a piece of German Silver swaged to the front of the outside plate, and to which the two handles should be fastened with silver solder in order to strengthen them. This should be done before it is soldered to the front of the outside plate.

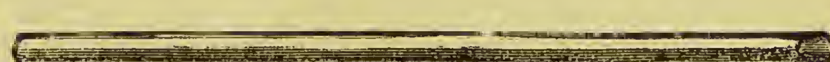


Fig. 23.

Fig. 23 represents the two handles, which are made of hollow German Silver tube. With the exception of the small front piece D, the various pieces can be soldered with soft solder, of course omitting the middle portion B.

To prevent the solder from filling up the hollow in the centre of the palate, a layer of whitening may be painted over the inside of the inner and outer plates, corresponding to the size of the intermediate piece.

Fig. 24 represents the finished tray.

To one handle of the tray about six feet of india-rubber tubing is attached, the other end of the tube being slipped over the nozzle of a Plunket saliva ejector.

Close to the other handle of the tray is attached by means

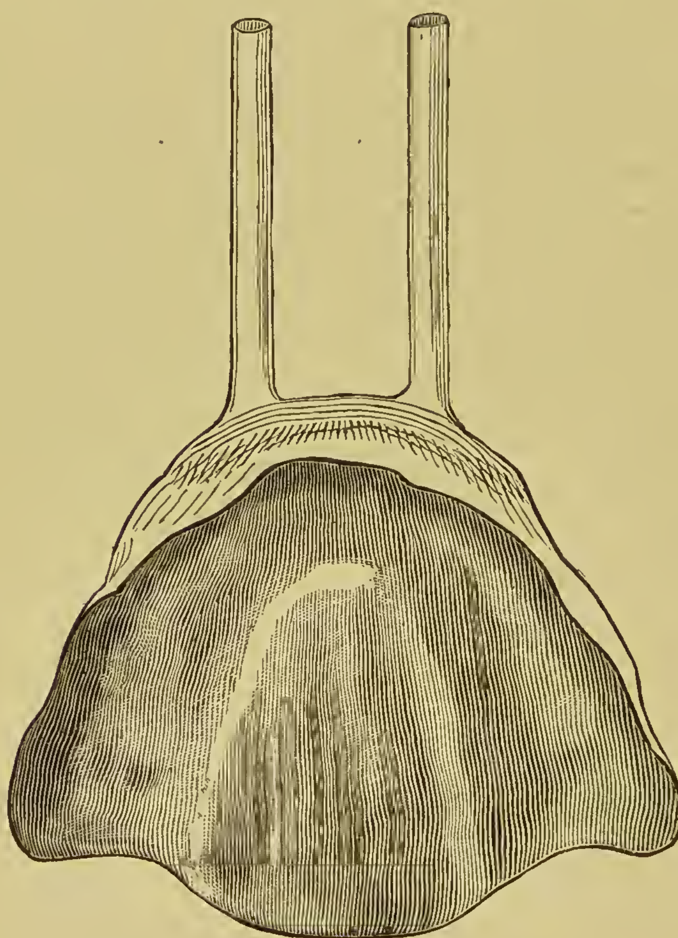


Fig. 24.

of a short piece of tubing, a little tap, such as is used on a face piece for filling it with air, and to the other end of the tap is attached about six feet of rubber tubing, which is fastened to a metal tube soldered into the bottom of a tank, large

enough to contain about a quart of water. This tank and the attachment to the tray to turn on the water, were introduced by Mr. Humby, and were needful to make the irrigated tray a success. The plate for making these trays should be about No. 7 guage.

The composition is inserted into the tray in the ordinary manner, the tank filled with cold, or even with iced, water, and the india-rubber tubes attached to the handles. The surface of the composition is then warmed over a spirit lamp and inserted into the mouth, and held firmly in position with one hand, while the small tap is turned on with the other. The effect is astonishing; the moment the cold water permeates the tray the latter becomes stone cold and hardens the composition in about one minute, so that it can be withdrawn from the mouth in safety.

This is a result that is appreciated both by the patient as well as the dentist. By the patient, because his period of suffering is soon over, and by the dentist because he secures the most accurate results with a minimum loss of time and anxiety.

It is perhaps the best advice to give and in the long run the greatest saving of time, to make a suitable tray for any mouth presenting difficulties, for we must not forget that the model is the foundation for our work, and however beautiful the superstructure may be, and however much skill and care may have been devoted to it, if the model is not correct, all that is thrown away and represents lost labour.

IMPRESSIONS OF EDENTULOUS MOUTHS.

In all cases the tray should be introduced into the mouth one side at a time, the cheeks at the angle of the mouth then drawn back and the other side inserted. The handle of the tray should be exactly in a line with the nose, before pressing it up or down in its place. In some small mouths it is convenient to draw the cheek back by a piece of thick note paper folded once or twice, or by a retractor ; this will allow of the tray slipping past the angle of the mouth ; it acts very much after the principle of a shoe-horn, and also prevents any abrasion of the cheeks.

This operation should be performed with calmness and deliberation, for not only is it essential for our work, but it also makes the patient feel that he is in skilful and competent hands.

In taking impressions of the lower jaw, the same care must be observed as with the upper, in drawing the cheeks out of the way, and when the tray is in position, a folded napkin in the left hand should be held under the chin, to support it, until the tray is removed from the mouth.

On no account should the patient close the teeth or gums on the tray to press it into place ; should such inadvertently happen, the best thing is to resoften the composition and try once more.

By drawing in the breath deeply the patient takes the soft palate and uvula out of contact with the composition, should any exude from the back of the tray, and it enables him to tolerate the material in the mouth without retching.

If the mouth is rinsed out with cold water just before the

impression tray is introduced the composition will harden the more rapidly.

In the case of a good impression of an edentulous upper, considerable force is required to remove it from the mouth, in fact by downward pressure on the handle of the impression tray, it would be difficult to effect its removal without hurting the patient, so it is usually found necessary to tilt it from one side to allow air to enter ; by so doing one is able to withdraw it more easily.

Should this method prove unsuccessful it is as well to ask the patient to go through the action of swallowing, while at the same time one draws down the handle of the tray, this seldom fails to bring the tray away.

Now, it seems likely that if the impression adheres so firmly to the roof of the mouth, the case if fitted accurately to the model, should do so likewise, and such we find to be the case.

If, on the contrary, the tray containing the composition comes away quite easily, one must carefully examine the impression, and if at all uncertain as to its correctness, it is as well to take the precaution of obtaining a second one, and at the same time warn the patient against moving during the process.

Should the impression still come away readily, one must inform him that the case may require springs ; at any rate his mind should be prepared for such an eventuality.

When taking impressions of the lower jaw, it will be found that the tongue has a great tendency to try and eject the tray from the mouth, and great care must be observed that the tray is in the centre of the ridge, and not thrust forwards.

It is essential that we get a good deep impression of the

mylo-hyoid ridges, as it is the amount of plate tolerated over these ridges that increases the stability of a lower set.

It is more necessary even than in the upper for the cheeks to be drawn away from the tray, for unless such is done a portion of the cheek in the vicinity of the attachments of the Buccinator muscles may be pressed down or folded over and thus not allow the tray to go fairly home.

This pressing down of the cheek may also take place by having too wide an impression tray.

IMPRESSIONS IN PARTIAL CASES.

In order to obtain an impression of a mouth in which natural front teeth are present, and also to avoid the necessity of using a large quantity of composition, a suitable tray having a recess in it for their accommodation must be used

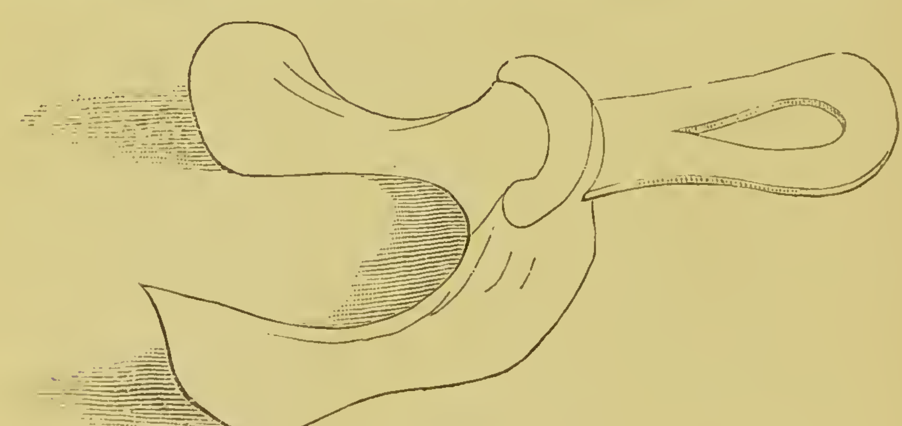


Fig. 25.

(Fig. 25) or else the tray should be so perforated as to allow the points of the teeth to pass through (Fig. 26). By either of these means a small amount of composition only is necessary, and the impression is obtained with greater certainty and more rapidity.

If a perforated tray is selected for use it will be necessary to press some composition over the points of the teeth when they project through the tray after it has been pressed into its place, and to effect this neatly a small German silver cap, (such as is shown in Fig. 27) may be used for this purpose. This cap should have some composition placed in it, and be handy for adjustment when required.

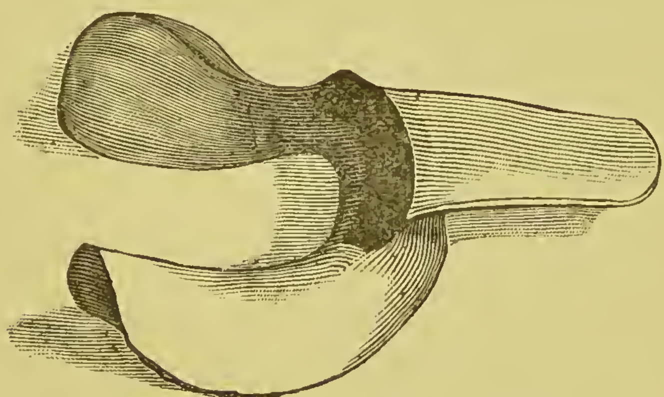


Fig. 26.

When there are very loose teeth in the mouth, which we cannot get permission to remove, care must be taken not to allow the composition to set too hard, or one of them might

Fig. 27.

perchance come away in the cast. When the teeth are long and straggling, or there are cavities existing, it is desirable to fill them with wax or moistened wool to prevent the entrance

of the composition, otherwise they would form so many retaining points, and render more difficult the removal of the impression from the mouth.

But the better way, where undercuts are presented, is to fill them up with composition in the following manner.

Let us take as an example, a lower jaw from which the first molars and second bicuspids have been removed. The second molars are tilted forwards and the first bicuspids leaning backwards ; thus we shall have a space presenting such an undercut, that an impression could not be taken without considerable dragging.

Now, to take a satisfactory impression of such a case, so as to insure the gum being perfect, we must first of all soften a little composition, and having previously rubbed a little vaseline over the fingers, mould the composition accurately to the undercut space or spaces in the mouth ; when hard this should be removed and trimmed up, so that it presents a wedge-shape, tapering to the points of the teeth. The pieces are then rubbed with vaseline and replaced in the mouth, after which the impression is taken in the ordinary manner.

When hard, the impression is withdrawn, leaving the composition cores still in the mouth; these are next removed, and inserted in their respective places in the impression, into which they should fit with the greatest accuracy.

They are then fixed with a small quantity of hard wax, and plaster is poured into the impression.

By operating in this manner, or in a modification of it to suit certain cases, most accurate results may be obtained.

Now, although it is no use making our work to fit such an undercut, as we could not possibly get it into the mouth, still it is very desirable that we get a perfect impression of the

gum in such a space. This we could not well do, if the impression dragged around the second molar tooth.

When there are long, straggling, or loose teeth, this plan answers admirably, as by moulding composition to the back of these teeth, trimming it up, and then moulding some more around the fronts, the two halves can be placed *in situ*, and the impression taken. Thus we can obtain a most perfect cast without exerting any force upon the tender teeth in the mouth.

This plan of taking impressions admits of any number of modifications, and is dependant for its success upon first having a material free from elasticity, secondly, on the lubricating of the fingers with vaseline while working the composition, thirdly, upon using as small an amount of composition as possible, and fourthly, upon the forming of suitable supports for the composition during the process of hardening. These supports are made of strips of German silver bent so as to approximate to the shape of the part of the arch for which they are intended.

CASTING THE PLASTER MODEL.

After having obtained an impression of the mouth by either of the methods set forth, the cavities in the impression represented by the natural teeth, should now have thin pieces of iron wire placed in them ; this is done by just warming the end and pressing it slightly into the composition at the points of the teeth. The pieces of wire should be about three quarters of an inch long ; the object of using them is of course to strengthen the plaster teeth.

The impression should then be dipped into cold water, and

shaken, to remove any surplus moisture; this will allow the plaster to run more freely into every part of the impression.

To obtain a model or cast of the mouth, plaster of Paris is mixed with water until it is free from bubbles, and is about the consistence of thick cream. It is then introduced a little at a time into one end of the impression, and carefully made to enter each cavity at the side, flowing into it without choking, and being shaken until it runs right round to the other side by this means the air is forced out of the cavities and replaced by plaster.

The imprisonment of air in any part of the impression will be shown, in the resulting plaster cast, by what is termed a "blow," and the presence of such flaws in certain parts of a model very often renders it useless for correct working.

When mixing plaster, some dentists put the water into the basin first and then let the plaster trickle into it. This is a very good way ; it does not require so much mixing, and there is less likelihood of portions of unmixed plaster being present, but it is a rather more wasteful method than that of putting the portion of plaster into the basin first, and then adding water to it, and incorporating it with a spoon, spatula, or broad-bladed knife.

In this latter case the plaster can be mixed thicker if necessary, in order to expedite its setting; it also increases the hardness of the model.

One must carefully avoid getting portions of unmixed plaster into the impression, by means of thorough incorporation prior to pouring, and by seeing that it is free from lumps.

The cavities formed in the model by the presence of unmixed plaster have an irregular crumbly appearance, whilst

a "blow," due to imprisoned air, is smooth and sharply defined. By both these methods of mixing plaster, equally good results can be obtained by the careful workman. After the impression has been filled, a portion of plaster about equal to the size of the model required, is placed upon a sheet of lead or zinc, and is worked up to approximate somewhat to the size of the impression, when it has set sufficiently to bear the weight of the impression; this latter should be turned over and pressed on to it, and the plaster moulded up round the sides. It is then left to harden.

If in casting a model for an edentulous upper or lower the shape of the impression admits of it, we can oil the surface of the impression and thus obtain several casts of it, the oil allowing the plaster model to part from the composition without destroying it.

But in the ordinary case, the cast when hard is placed in hot water for a few seconds ; this heats the tray and permits of its removal from the composition. The cast and composition are then replaced in the hot water until the composition is so soft that it may be removed from the model, which is afterwards trimmed up with a sharp strong knife to a suitable shape. If the model is required for a gold or other metal plate, it has to be cast much thicker than if the case is for vulcanite, in order that the zinc casts to be hereafter described may be produced sufficiently thick to resist the blows of the hammer in striking or swaging up the plate. Thus for vulcanite, a model need not be more than one inch in depth, whilst two inches would be about the thickness required for a model for plate-work. Before pouring plaster into a plaster impression it is necessary to apply to the surface of the impression a solution of soap, or if the plaster

impression is quite dry, a coating of shellac varnish, and after the varnish has become quite hard it is covered with a little oil. The object of this is to ensure a parting between the model and the impression when the former is hard. After the model has been trimmed up it is put in a warm place to dry slowly, if intended for a plate, and when all moisture has been driven off it should be either varnished, or boiled out in stearine or in a mixture of two parts beeswax to one part resin. This hardens the plaster and renders the surface of it less likely to be rubbed in the subsequent operations upon it. For vulcanite work it is unnecessary to specially dry the model except for regulation cases, &c.

After obtaining the plaster casts, our next care is to model pieces of composition to represent as near as possible the size, depth, and outlines of the future case or cases. These pieces must be sufficiently deep to give us the length of teeth in each jaw, also their inclination, thus enabling us to restore to

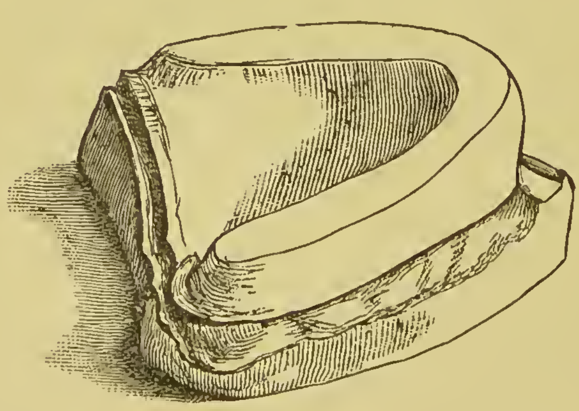


Fig. 28.

the features their lost expression, by causing the lips and cheeks to resume their former outlines. We must by these means get the slant of the teeth and the centre of the mouth,

and lastly it must give us a correct idea of the perfectness of our model. In order to ensure this latter result, we must take some amount of care in the manipulation of these dummy pieces or bites, in making them fit the models, and be sufficiently strong and rigid to resist the pressure of biting without becoming bent, as would be the case were we to use a material such as wax for instance.

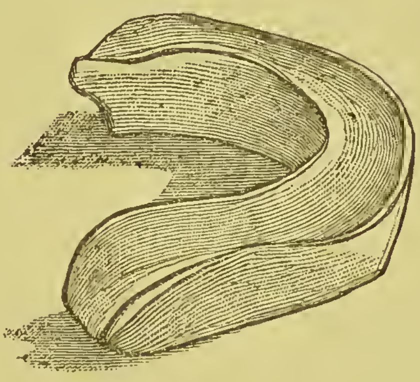


Fig. 29.

The way I recommend for making these pieces is the following:—

Take the plaster model and dust it with French chalk, then soften a piece of composition, and flatten it into a plate about $\frac{1}{8}$ of an inch thick and sufficient to represent the size of, or a little more than, the future case; dip it into the hot water again, to make quite soft and then carefully press it over the surface of model. Before it gets quite hard, mark the outline of the size with a sharp knife before removing it from the model. By doing this it is trimmed up much easier, the composition readily breaking away at the incisions, and the subsequent finishing touches can be done with a moderately rough rasp. Now we must take a piece of strong iron

wire, about twice the thickness of pivotting wire, and bend it into the shape of the alveolar ridge, after which it should be made hot in the flame of a spirit lamp, and sunk into the composition plate. In shallow bites this strengthener must be placed so that it does not interfere with the proper closure of the teeth. After this operation another piece of composition is softened and moulded into a roll sufficiently long to extend round the arch of the alveolus; this is to represent the size and length of the teeth, and it is made to adhere to the composition plate by warming the surface over a lamp.

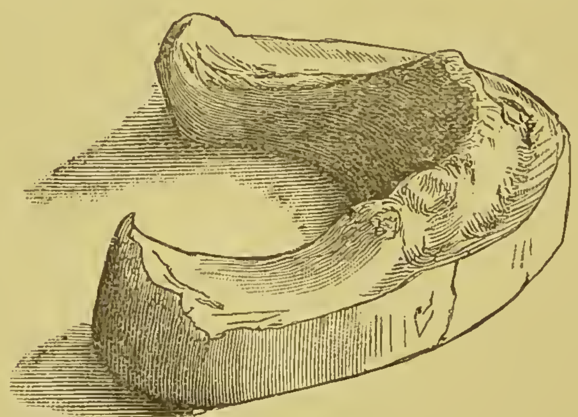


Fig. 30.

It is then trimmed up with a knife and rough rasp, and is ready for use to obtain a correct bite. The neater one makes these dummy cases, and the more they approximate to the size of the future set, the better guide they will be to the construction of the set and the arrangement of the teeth. When there are teeth in the mouth which articulate with each other, taking the bite is a very simple matter, it is then only necessary to trim the composition cases, after trying them in the mouth, until the teeth nearly articulate; then to complete the operation, the surfaces of the dummy pieces are softened

over a lamp, and the patient directed to close the teeth firmly and keep them so for a short time, or until the composition is again hard. But to obtain the proper closure of the mouth in edentulous cases requires a more delicate and skilful operation.

In this case when the pieces are placed in the mouth they are generally found to be too high, that is, they keep the mouth too widely open, so the pieces must be carefully cut down until all parts of the surface come into contact, and the lips assume their natural position, and there is no strain on the lips in closing the mouth.

We must now soften slightly the surface of the upper piece and place again in the mouth, getting the patient to gently close on the softened surface, this closely approximates the pieces together, the centre of the mouth is then marked, the length of the upper teeth taken, so that enough, but not too much, of them is shown when the patient talks or laughs. The pieces are then cemented together at the sides by means of a warm instrument. It is very essential that the patient closes the mouth properly,—I mention this because it is not at all an uncommon thing for a patient to give a wrong bite, either by protruding the lower maxilla, or else moving it sideways. Of course, the skill and discernment of the operator should enable him to recognise when the patient is giving a wrong bite, and to take means to remedy it. I find that the position of the patient's head in the chair makes a considerable difference in the closure of the mouth, the more upright it is the less likelihood is there of the lower jaw being protruded. This form of false bite is the most difficult to avoid, the lateral displacement of the jaws being easily recognised by the heels

of the models being thrown out of relation to each other when the dummy pieces are articulated.

In some cases, owing to the patient's nervousness, or other causes, it is found necessary sometimes to adjust springs and swivels to the dummy cases in order to keep them steady enough in the mouth for one to inspect them properly. A common set of swivels can be used for this purpose, and if the bolts of the swivels are flattened and warmed and then pressed into the composition they will be found to hold sufficiently firm for the work required of them. With these dummy cases we are enabled to judge of the correctness of our models and also of the stability and holding power of the future cases.

Where the patient is already supplied with teeth in one jaw, it is well to bear in mind that, after the dummy piece has been adjusted to the other jaw and removed from the mouth, the dentist should take an impression of the points of the teeth in the case the patient is already wearing and afterwards pour plaster into it, as into an ordinary impression. Then he should articulate the resulting model to the marks on the dummy case and mount both in a bite frame. This enables one to dispense with the case that the patient is wearing, as he very often does not like to be left without altogether. Too much caution cannot be exercised in obtaining a correct bite; a few minutes extra time spent at this stage of our work will often save an hour's labour when the case has to be adjusted to the mouth. For gold work it is best to strike the plates at first and then mount the composition on them to take the bite—by this method you test the fit of your plates, which is of considerable importance. In taking bites for simple cases, such as single teeth, or even for the loss of several teeth when there are others at each side of the space—a piece of soft com-

position may be moulded to the gum and the patient directed to bite into it; to manipulate the soft composition in the mouth the fingers should be lubricated with a little vaseline. When by means of one of the foregoing methods a representation of the proper occlusion of the jaws is obtained the dummy pieces are placed upon the models, and they are mounted either upon a bite frame, or set upon a plaster slab, or in other ways to be described hereafter.

SETTING UP BITES.

The setting up of a bite, is the placing of the models of the mouth in exactly the same relation as the upper and lower jaws bear to each other, and the object is to show with accuracy the amount of space which has to be filled up with teeth in order to obtain a proper and efficient masticating surface.

As models may be set up in several different ways, we will first of all enumerate them, and proceed afterwards to a description of their arrangements and the advantages each possesses.

The Slab bite. Long bite. Heel bite. Bite frames. Small bites in composition.

The Slab Bite.—The models of the mouth are taken and crucial grooves are cut in the heels or back of them. (Fig. 31.)

The dummy pieces previously described are now carefully adjusted to the models so that they go perfectly home, any portion interfering with this should be cut away. Great care must be observed in doing so, to get accurate results, for an omission will entail a great amount of trouble and inconvenience when the case is tried in the mouth. The

two models with the intermediate dummy pieces in position are now fastened together with hard wax, and the grooved ends of the models are painted over with a solution of soap; this will prevent the plaster adhering to them. We now mix up to a thick consistence about four tablespoonfuls of plaster of Paris and spread it on a piece of zinc or glass. It should be spread out so as to just extend beyond the edge of the models which must now be pressed gently but firmly into it, and held in position by the left hand until the plaster hardens, whilst with the right hand the plaster is worked by means of a spatula or knife round the back and sides of the models.

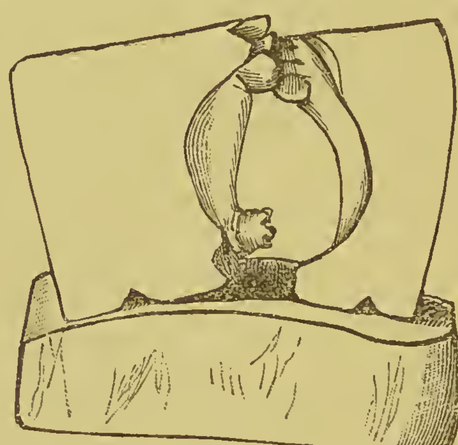


Fig. 31.

Now, although one may, by mixing the plaster thick, and holding the models in place until the plaster hardens, think he has got a reliable bite, such is not the case, for in the process of hardening an expansion takes place in the plaster slab that always separates the models to an appreciable extent, this rendering the slab bite uncertain in its results. To overcome this expansion somewhat it is best to use an old plaster slab and after trimming roughly into shape dip it into

water and on the surface of the slab spread a very thin layer of fresh plaster just enough to form a bed for the models. This thin layer of plaster by adhering to the old portion is controlled and prevented from expanding, at any rate to such an extent as in the method previously described.

The advantages of the slab bite if they can be so considered are, that the workman is able to use models of any thickness, and remove them with the greatest ease for the purpose of fitting clasps of teeth, and it is principally used for gold and other metal work. A bite frame known as Howarth's, sold by the D.M.Co., presents an ingenious modification of the plaster slab in as much as it admits of the free removal of the models —and also of the use of only a small quantity of plaster—but unfortunately the inventor has, to our mind, detracted from the utility of his invention by introducing a lettered surface for the plaster to rest on. The effect of this (when the expansion of the plaster takes place between the raised letters) is to prevent the plaster from going into close contact with the frame again—instead of letters two raised taper ridges crossing each other should be the only attachment. By this arrangement the expansion of the plaster would not affect the position of the models on the bite frame.

The next bite or articulator to be described is:—

THE LONG BITE.—(Fig. 32)—This form of bite affords a much more perfect articulation than the preceding, and may be relied upon to give very accurate results.

To make this form of articulator neatly, two moulds made of strips of zinc or tin are necessary; the first should be about 7 inches long and $1\frac{1}{2}$ inches wide, and the second the same length, but just double the width of the first.

Two inches of each extremity of these strips are bent at

right angles, the back part should represent the width of the model, therefore the two arms will grasp about ½ an inch of the sides, leaving the rest to form the necessary extension to the model. We now proceed in the following manner.

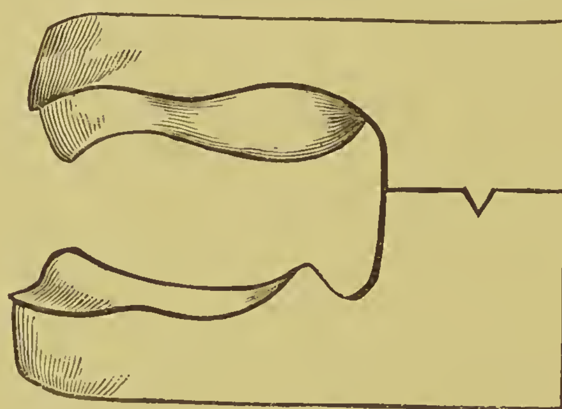


Fig. 32.

The plaster models are cut down to about an inch and a quarter in depth in front, tapering to three quarters of an inch at the back.

About four tablespoonsfuls of plaster are now mixed tolerably thick, and after moistening the under surface of the plaster model, a quantity of plaster sufficient to make the model level again is placed on a sheet of zinc or glass and the model pressed gently into it, thus there will be about half an inch of fresh plaster under the back of the model, while at the front part there will only be a slight film. The zinc frame is now placed in position, just embracing the sides of the model, and it is then filled up with plaster level with the surface of the frame, this will give us the proper height and amount of extension necessary.

When the plaster has set, the surface is smoothed, and transverse grooves are cut in it. The upper model and

dummy pieces are now adjusted to the lower part and fastened in position by hard wax. The fresh plaster surface of the lower part of bite is now painted with a solution of soap, and the deep zinc frame is adjusted to it in the same way as

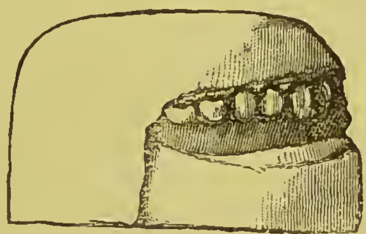


Fig. 33.

described for the narrow frame. Some plaster is now mixed up, and it is moulded to the surface of the upper model and the lower bite, and the frame filled up level as before. When the plaster is set, and the zinc frame removed, we should have a bite as represented in the cut.

It is necessary now to hollow out a portion of both upper and lower extension, so as to get a good view of the backs of

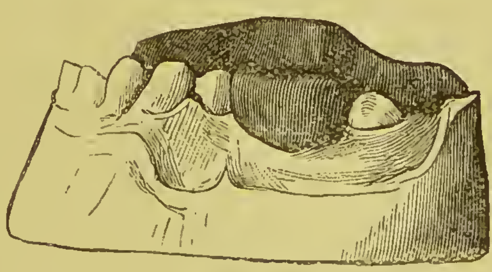


Fig. 34.

the teeth when mounting them. The advantages of this form of bite are that any expansion of plaster will affect it equally, both in the molar and incisor regions, and if neatly made these bites are very handy to work to.

The heel bite (Fig. 33) is one more often used for remodelling cases, and is made in this way. The model is taken and the case to be remodelled is fastened to it. A piece of wax is now softened, and the palate portion of the case is built up level with the teeth, a transverse groove is now cut in the heel of

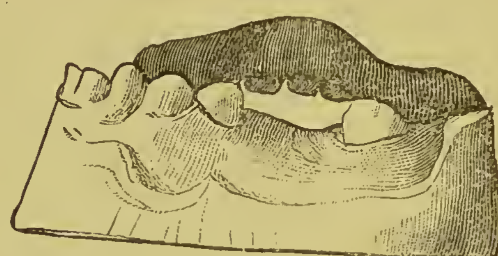


Fig. 35.

the model, and lubricated with soap, whilst to the wax and teeth a little oil is used. A quantity of plaster sufficient for the purpose is now mixed pretty thick and worked over the back of model, and brought forward until it covers the crowns and points of the teeth, it is now allowed to get hard and then separated from the other portion.

For partial cases of two or more teeth, and where there are teeth on each side of the gap, a little soft composition may be pressed into the composition dummy, and extended so as to rest on the neighbouring tooth or teeth. The dummy case should have been oiled, and after pressing the soft composition into it, should be dipped into cold water and separated; by this means a small bite can be accurately made in two or three minutes. (Fig. 34, 35.)

We now come to bite frames, and we must give these most consideration, as it is by this means we obtain the most accurate results.

A bite frame to be effective should be simple in construc-

tion, not liable to get out of order, and should be so arranged that the models may be fastened to, and removed from it without any fear of altering the articulation. The bite frame that is illustrated is one that has the merit of both these

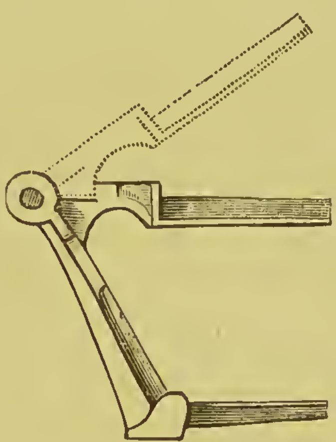


Fig. 36.

qualifications, and is to be depended on for the most accurate results. By referring to Fig. 36 it will be seen that there is only one joint to be looked after, and that any interval existing between that joint will at once point out that the bite is too high, or in other words, that the teeth come in contact

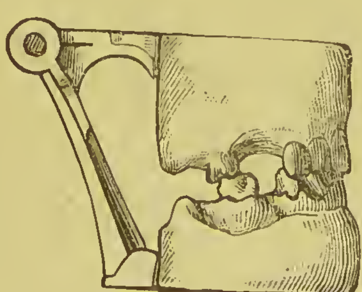


Fig. 37.

with each other too soon. To arrange the models on this frame, it is necessary to trim them down so that when fastened

together, they can be placed between the two arms without in the slightest degree raising the hinged upper one. The two bevelled and taper portions of the arms are now oiled, some plaster is mixed and spread over the lower arm, and the models placed so that the arm comes exactly in the centre, and near the anterior part of the model. When the plaster has set, some more is spread on the upper model, and then the upper arm is pressed down into it until the joint comes perfectly close. The plaster is now smoothed around the models and arms of frame, and is allowed to harden. By previously oiling the frame the plaster models can be removed at will.

If the models are for vulcanite work it is more convenient to taper the sides, and soap the bottom of the models, but if this is done grooves must be cut in the sides to form retaining points for the plaster to hold to. If, however, the models are for plate work, they should be made to adhere firmly to the added plaster, so that they can be removed from the frame and re-adjusted again in case they are wanted at some future time.

When using any bite frame, the models should be brought together without the slightest jar, and care must be taken that the points of the teeth are kept absolutely perfect.

In the case of a model used as a bite it is best to dip the points of teeth in hot stearine or melted wax, or to give it a coating of shellac varnish ; this will prevent the red paint, afterwards used, from drying and accumulating on the teeth; one is then able to use a very thin coating of paint.

CASTING IN METAL.

The requirements for this work are :—

A strong deal box about twenty-two inches square and eight inches deep, with a quantity of sand, or loam, sufficient to occupy half the space in the box. Some half dozen casting rings are also wanted, these are usually made of iron and are about three inches in depth and from three to four inches in diameter, and may be obtained at any of the dental depôts.

Much neater and cleaner casting rings may be obtained by getting sections of thick brass tubing ; these sections can be cut to any length, and one can obtain gradations in diameter, that will admit of one fitting into the other. They have the advantage over iron, inasmuch as they do not rust, and therefore do not contaminate the sand by portions of the mould flaking off.

Besides these appliances, it is needful to have a common knife with a blade about two and a half inches long, also a double-ended steel spatula, and a pair of tweezers.

As a valuable adjunct to the coke furnace previously mentioned (Fig. 3) the workroom should not be without one of Fletcher's gas ladle furnaces. This is most handy and convenient to use, as it does not entail the trouble of lighting a coke furnace, simply for the sake of casting a die and counter.

This furnace should be so placed that the fumes of the gas shall go up the chimney.

Thin wrought-iron ladles should be used with this furnace for melting the lead and zinc.

The sand should be kept quite free from all particles of zinc, lead, or other impurities, and after it has been used it

should be pushed in a heap against one side of the box, and moistened either with a little stale beer or water ; this leaves it ready for use the next time it is required. When adding water, etc., to the sand, care must be taken not to make it too moist, or else it will adhere to the plaster model, and will also cause the zinc to bubble when it is poured into it, and so destroy the cast. The sand should just hold together when a handful is taken up and pressed. Should impurities or particles of metal get into the sand, it should be dried and sifted through a fine sieve.

The plaster model to be cast should represent if possible the thickness required in metal, and prior to being cast should have been boiled out, either in a mixture of resin and wax, or stearine, and then allowed to cool. Another plan is to dry and varnish the model, with methylated brown spirit varnish.

The model must now have all undercuts filled in, and all defects made good ; it should also be padded slightly, that is, have a thin film of wax melted on to the rugæ, if they are pronounced ; in fact any prominence that is likely to suffer in swaging up the plate should be treated in this manner.

The model should now be dusted with French chalk, or Licopodium, and placed on the floor of the sand box. A casting ring is next placed around it, then sand is sprinkled over and pressed down at the sides of the model, whilst the mould is filled up with more sand which is pressed or hammered down with a light wooden mallet. Any surplus sand should now be smoothed-off, and the mould turned over, thus presenting the bottom of the model to view. It is presumed in this instance that the model presents no difficulties to prevent its easy withdrawal, so it may be removed

from the sand by either one or other of the following methods :—

First, take a steel point, (an excavator with the point broken off and re-sharpened makes a very suitable one), and drive it a short distance into the centre of the under surface of the model with a light hammer, say one about the size of that used for rivetting.

The steel point should now be held in the left hand close to the end, and should be gently tapped on each side close to where it enters the model, this is to loosen the model.

We next hold the steel point with the thumb and finger near the model, so that we can rest the points of the other fingers on the edge of the mould ; this is to steady the hand during the withdrawal of the model.

The point should now be tapped gently on the end, not to drive it further into the model, but rather to loosen the model as it is raised from the sand. This method of withdrawing a model is most useful in those cases where one has sometimes to tilt the model a little in order to get an impression of a slight undercut.

By tilting is meant giving the model a slight bias away from the undercut part. Thus, supposing the undercut is on the lingual surface of the lower teeth, then the model should be gently raised, giving it at the same time a slight pressure against the sand in front. Supposing on the contrary, that the undercut is present on the labial aspect of an upper model then the bias should be against the back part of sand mould.

The art of casting in sand properly is only to be acquired after a good deal of practice ; it requires much patience, a steady hand combined with great delicacy of touch, and it

should be constantly practised by the pupil during his period of training.

The second method for removing a model from the sand, is to take the casting ring in the left hand, with the model downwards, and gently tap the bottom of the model with a small hammer ; it will then drop out. Care should be taken that there is some sand for it to fall upon, or else it is likely to be injured. If the sand impression is perfect it should be placed on one side until the remainder are cast, and then, if the zinc has been put on the fire to melt, it will be ready to pour.

On no account must the zinc be made too hot, but only just be melted, and while in the molten condition some sal-ammonia or fat should be thrown into the ladle, this prevents oxidization, and produces a clean surface on the molten metal.

When pouring the zinc into the mould it should run down one side ; if it is thrown in all at once, air may be imprisoned in the mould, causing a spluttering and "blowing" of the metal to take place, and so spoiling the cast.

A thin wrought-iron ladle is the best to use if one is melting zinc or lead in one of Fletcher's gas furnaces—but if an ordinary brick furnace is used, then a strong cast or malleable cast-iron ladle is more economical, as it will last out five or six of the ordinary kind.

When set, the zinc model should be removed from the sand and cooled, and if the zinc has not been overheated, the sand will part from it readily and leave the zinc with a clean bright surface.

Apart from the fact that the overheated zinc makes a bad

cast, the metal oxidises rapidly and a considerable waste of metal is the result.

The next business is to make the leaden counter dies, and we should be guided in this respect by the size of the plate wanted.

If the plate we propose to swage up is not required to cover the palate, we may use an iron mould similar in shape and size to the casting ring, (Fig. 38), (only with a bottom to it), and have it nearly full of melted lead.

The model should not be dipped straight into the molten lead, but slightly tilted, the teeth placed in first, and the back part slowly lowered to the required depth ; the object of this is to allow air to escape at the back of the palate.

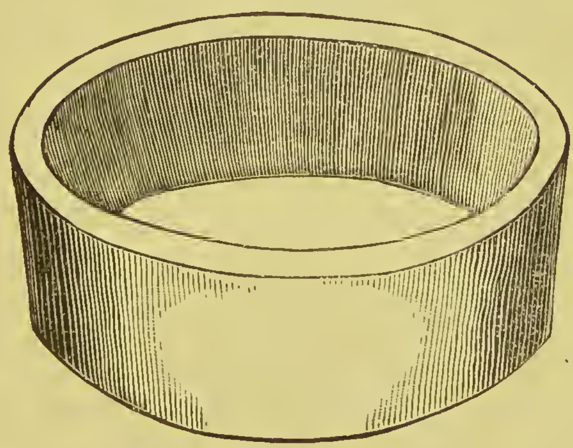


Fig. 38.

The model can be held between the thumb and fingers and inserted just as the lead is on the point of cooling, therefore before it has time to burn one's fingers the lead is sufficiently set to hold the model in place. In lieu of the hand, a pair of tongs, or an old worn-out pair of forceps will answer the same purpose.

It is a very common mistake to dip the zinc model too deeply into the lead ; it not only takes away from the substance of lead to strike into, but at the same time renders the swaging process more difficult.

Two dies and counter dies are usually sufficient for an ordinary plate, but if an extra die should be necessary, then it should also have a new counter-die.

A warning may here be given that the mould be kept free from moisture, or else the steam generated when the molten lead is poured into it, will cause an explosion and scatter the lead about the place. It is as well always, when pouring either lead or zinc, to keep the face as far removed from the mould as possible.

When a perfect impression of the palate in the counter-die is required, it is necessary to proceed in a different manner to the foregoing.

In this case we take the zinc model, and sink the base of it in a bed of sand, leaving exposed the teeth and palate. Now place around this, the casting ring (Fig. 38), letting the edges of the ring just sink into the sand in order to prevent the lead from running out ; a little more sand is pressed around the outside of the ring, and in the meantime if the lead has been melted it may be poured into the ring, slowly, until the ring is nearly filled up.

When the lead has hardened, it and the zinc model may be removed from the casting ring, which is made somewhat taper for this purpose.

Another method for obtaining a counter die, and one which possesses certain advantages, is to take the zinc die, and place it on the floor of the sand box, then encircle it with a casting ring, formed of one of the brass sections previously men-

tioned, and which should be about three inches deep. Fill up the ring with sand as if one was casting the plaster model. Now, if the ring is carefully raised the zinc model will fall from the sand by its own weight. We then take the ring in the left hand, and with a moderately long-bladed knife cut away the sand, bevelling it in such a manner that when the zinc die is replaced the teeth, palate and alveolar borders will be fully exposed (see Fig. 39). The sand should be bevelled

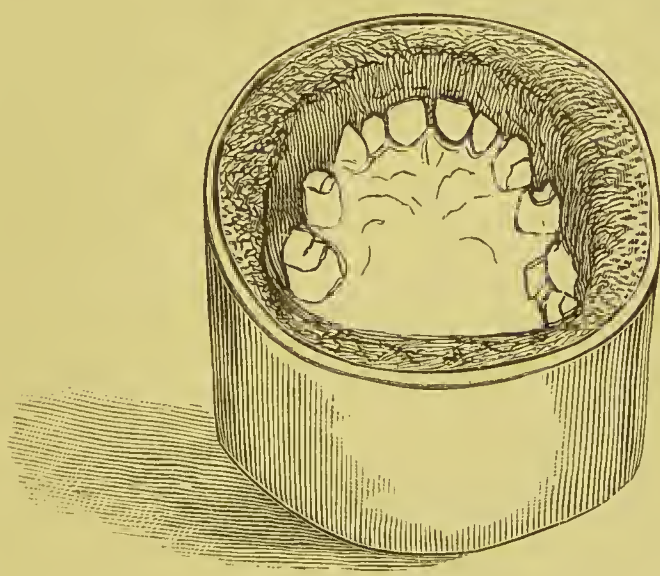


Fig. 39.

away from the sides of the model to the upper edge of the mould, or according to the size one requires the lead counter to be; it should however, always have a fairly broad base.

The zinc model should now be placed on a smooth layer of sand, the casting ring placed over it, and the edges sealed up with sand to prevent the lead running through. Melted lead is then poured on to the zinc model until the required depth

of the counter is obtained ; this should be about one and a half inches.

Wrought iron rings are often used to encircle the counter die, during the process of swaging, and are meant to support the lead and prevent it from spreading, thus ensuring a more perfect adaptation of the plate to the front and sides of the alveolar border.

DIFFICULT MODELS WITH UNDERCUTS.

Having described the methods for obtaining a simple die and counter, we now come to those difficult models, of which a satisfactory casting cannot be obtained in the ordinary way.

When the undercut is only trifling and confined to the sides and necks of the teeth, a little padding of wax will do away with it and allow the model to part from the sand. This added portion has to be trimmed away with a file and sculptor from the zinc die before the plate is struck up. With cases of great irregularity it is necessary sometimes to cut the teeth off the model altogether, and when this is required the pins that are put in to strengthen the plaster teeth should be smooth and straight. The plaster teeth may then be sawn partly through and broken, so that they can be removed from the model, and replaced when the zinc dies have been obtained.

A better way than this is to take two impressions of the mouth, and cut off the teeth of one, while the other is left to work to. This method insures the teeth not being misplaced

in fixing them on the plaster model again, as might easily take place in the first-named plan.

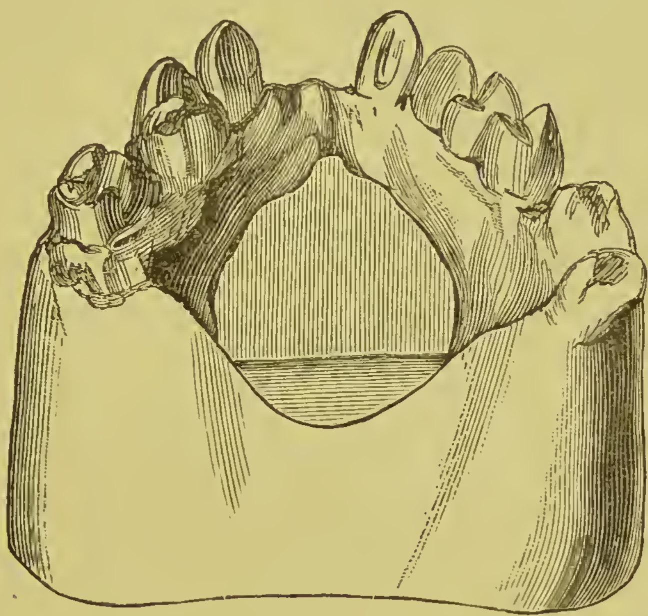


Fig. 40.

Another method, and one that spares the patient the infliction of a second impression, and is at the same time very reliable, is to accurately mould up a plate of composition to

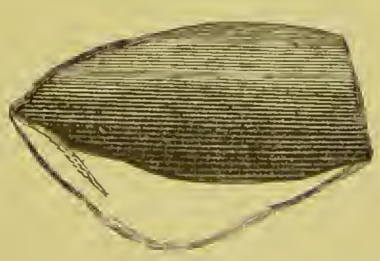


Fig. 41.

the plaster model to copy the gum, but not to extend up the teeth; it should be a trifle larger than the plate required. Pour plaster into this in the usual way to form a model, and

then use it to get the zinc dies and lead counters, with which the plate is to be swaged.

If the composition plate is made carefully, a very good fit

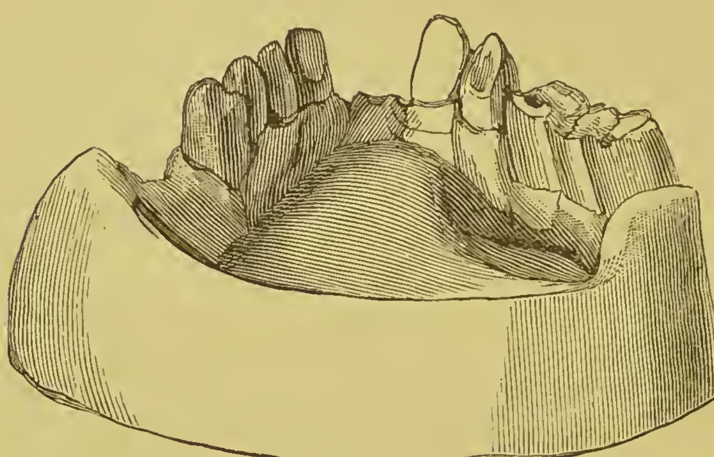


Fig. 42.

will be the result, and this without damaging in the slightest degree the plaster model.

Again, there are models which have the rugæ, or the alveolar ridges, considerably undercut, to these it may be neces-

Fig. 43.

sary to make a core of brickdust and plaster, pumice and plaster, or other suitable materials, in order to fill up difficult places.

The Cores. Fig. 40 represents an upper model with a core filling in a very deep palate. Fig. 41 represents the core itself. Fig. 42 is a diagram of a lower model showing an extensive undercut on the right side, caused by the molars leaning into the mouth. This was filled up by the core represented by Fig. 43, and Fig. 44 shows the core in position.

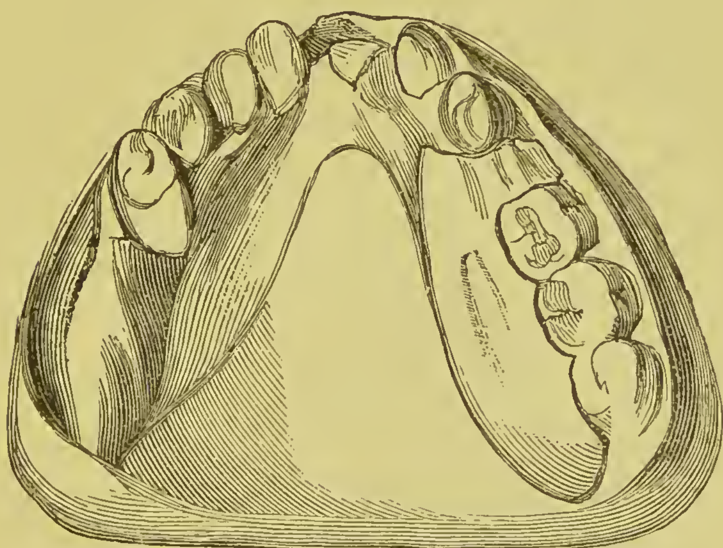


Fig. 44.

It will be seen at once by these models that the object of a core is not only to reproduce the undercut, but that it at the same time converts a difficult casting into one extremely simple.

The cores should be carefully dried and then slightly fastened to the model with a spot of wax. When the model is cast in the sand, the core or cores should come away with it, and on removal from the model, should be carefully replaced in the sand. The zinc is then poured into the sand impression in the ordinary way. It is perhaps as well to hold

the core in position with the steel point until the metal just covers it ; there is then no fear of displacing it. By this method one is enabled to cast very difficult and intricate models.

Making Cores. Taking a mixture of about two-thirds brickdust and one-third plaster of Paris, it should be stirred with water to a very thick paste, and kneaded into the irregular space on the model, which should previously have been well lubricated with thick oil or soap, to allow of parting.

Some cores are so difficult to make, (owing to the risk of breaking them in removing from the model), that it is found necessary to make a composition core first, and to duplicate this in brickdust and plaster.

This is not a difficult undertaking if we make sections of its surfaces either in composition or plaster of Paris. When the sections have been separated from the composition core, a hole is cut through from the outside, and on putting the sections together again, the inside is filled with brickdust and plaster.

There is another method of obtaining a perfect casting, say of an upper model, where one finds it is necessary to bring the plate well over the alveolar ridge. We presume of course that the ridge is so pronounced that it forms a considerable undercut on its labial aspect.

Take an impression of the plaster model in sections with composition as follows :—

After dusting the model with French chalk, soften and mould a piece of composition to the palate. When hard remove it and bevel it to a fine edge, with a sharp knife or file, at the alveolar border.

Make one or two grooves in it to serve as guides, and then

apply more composition to fill up the undercut along the labial and buccal aspects of the ridge, moulding it in such a manner that it slightly overlaps the palate portion.

When hard, remove the sections from the model, and fix them together with hard wax. We must now oil the inside of the impression thus formed.

A small portion of plaster is then mixed, and poured or pressed into as much of the undercut, as it will, when hard, part readily from.

While in a semi-hard condition in the impression it should be neatly trimmed with a spatula, and any excess removed. The edges should be clear and well-defined, and one or two grooves should be made in it with a half round sculptor; it may then, when hard enough, be removed, and further trimmed up, after which, the plaster section is replaced in the impression. Of course, if it be found necessary, two or more plaster sections may be made, each being treated in a corresponding manner to the one first described. After placing the plaster sections in the impression, the surfaces of impression and plaster sections are to be lubricated, the first with oil, and the latter, with solution of soap, then the remaining portion of plaster is mixed up and poured into the impression to complete the model.

When the plaster has thoroughly set, the great bulk of the model will part readily from the composition impression, and the two portions that form the undercut may be removed with equal facility.

This model may now be put on to a warm place to dry, after which it should be boiled out in stearine, and it is then quite ready for casting in sand.

Put the different parts of model in position, dust with French chalk, and place the model in the floor of the sand box, inside a casting ring.

Fill in the ring with sand, supporting the sections of model until the sand holds them firmly in position, fill in remainder of sand and press fairly home and smooth level.

The ring is now reversed and a sharp steel point is driven into the bottom of the model, and then, after tapping sufficiently to loosen, the latter is withdrawn in the usual manner. The part that comes away is that corresponding to the palate of the case, and the portions of model representing the undercuts are left behind ; these are then withdrawn, without any difficulty, by melting a small spot of hard wax on to the centre of each, afterwards making the handle of an old excavator warm and attaching it to the wax. This will give a sufficiently good hold for the removal of the plaster sections.

By operating in this manner a most perfect model in metal can be obtained.

There is nothing to prevent one from serving the original composition impression of the mouth in the same way as the one described, and it would have this further and important advantage, that it would allow of the plate being easily taken off and replaced on the model, which if the model were in one piece could not be done.

When one has a patient with long and straggling teeth, and a plate is thought advisable, the following plan may be adopted with success to obtain a cast. When the impression of the mouth has been taken, cavities represented by the teeth should be packed with Sullivan's Cement, inserting into

each socket at the same time, a piece of iron wire that shall project about half an inch.

The cement is now formed into a cone from the base of the sockets to the point of the wire, and then slightly grooved on each side. When all the necessary cavities have been filled with cement and carefully trimmed up with a burnisher or smooth spatula, plaster may be poured into the impression after it and the Sullivan cement teeth have been oiled. The model should now be laid aside for twelve hours to harden. When ready, it is placed in hot water, and the composition softened and removed.

We now have a plaster model, with metal teeth, which can be removed and replaced with equal facility, in their proper direction, and respective places. The model is trimmed up, dried, and boiled out in stearine, the cement teeth having been previously removed. These should now be replaced, and the model cast in sand in the ordinary manner. In this case the whole of the model, with the exception of the teeth, comes away first, and the teeth are removed singly from the sand afterwards. Thus a perfect cast with the teeth in position can be obtained—on the other hand, if the teeth in position are undesirable, the model can be cast without them.

By either of these methods most difficult and complicated casts may be made.

Besides the methods already enumerated, the cast of an undercut model may be obtained by using a mould or flask as represented by Fig. 45: this mould was invented by Dr. Hawes, and for the following description of how it is used, and also the illustrations, the author is indebted to Harris' Principles and Practice of Dentistry. If the model be considerably

smaller than the space between the flanges projecting inward, small slips of paper may be placed in the joint, extending to the sides of the model so as to part the sand when opening the flask for the removal of the pattern.

The sand may now be packed around the model up

Fig. 46.

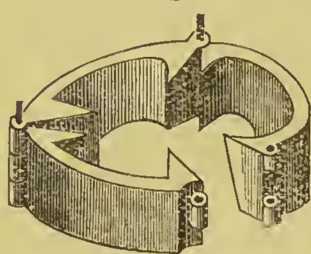
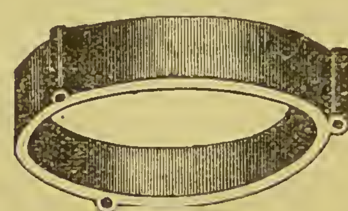


Fig. 47



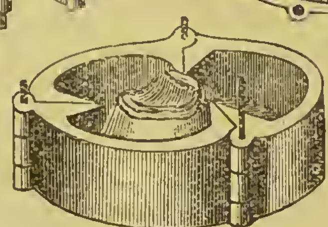


Fig. 45.

to the most prominent part of the ridge. It should be finished smoothly around it, slightly descending towards the model, so as to form a thick edge of sand for the more perfect parting of the flask.

The sand and face of the model must now be covered with dry pulverized charcoal, sifted evenly over the whole surface. When this is done, the upper section of the flask is placed over the lower and carefully filled with sand.

It is then raised from the lower one, which may now be parted by removing the long pin, and the model taken gently away. When closed, and the two put together again and inverted, it is ready to receive the melted metal.

In Fig. 46 the lower section of the flask is slightly opened to show joints. In Fig. 47 the upper section. In Fig. 45 the lower section is closed and confined by a pin, with the plaster model placed in it.

For obtaining a perfect cast of a pattern or model that is representing both the back and front, as well as the sides, a

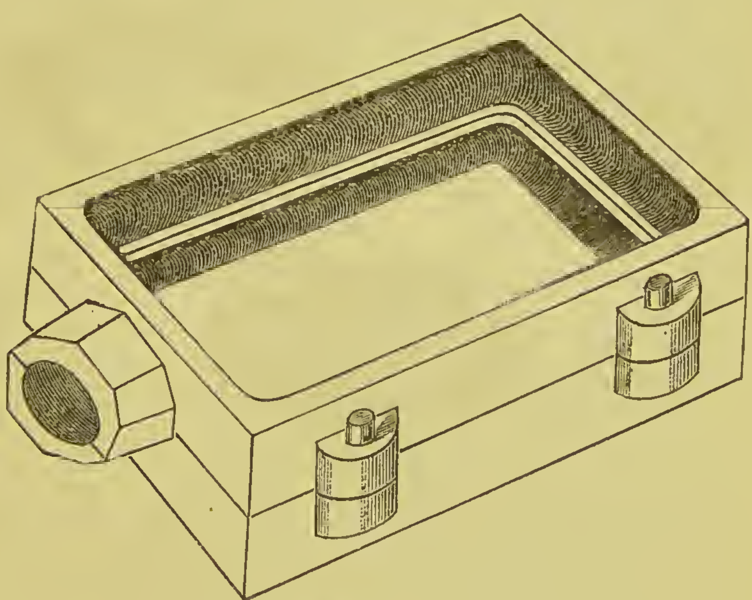


Fig. 48.

double mould may be used similar to the one illustrated, Fig. 48. With a mould such as this, we are enabled to make the castings to form the mould for a soft rubber velum, or any other cast of a similar nature.

The method of using this appliance is the following. After separating the mould, Fig. 49, place one half on the floor of the sand box and fill loosely with sand, then press the model or pattern into the sand, so that it will withdraw without drag-

ging, then condense sand around the pattern, make smooth and bring up level with the edge of the mould.

The exposed surface of the sand and the model is now dusted with French chalk, Lycopodium, or dry sand, and the other half of the mould is adjusted to it, this latter is then filled with sand which is pressed down so as to copy accurately the model.

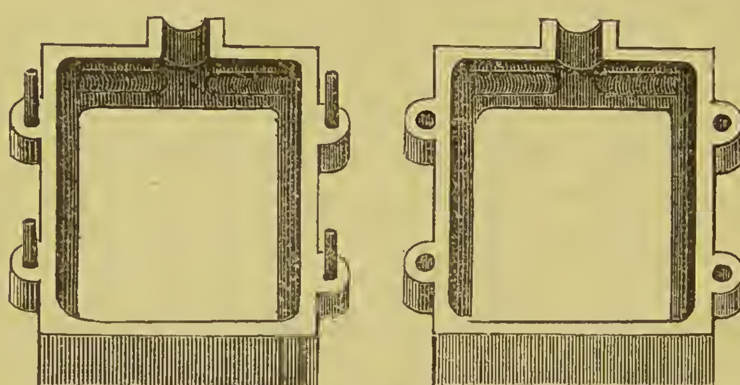


Fig. 49.

The mould is then separated carefully and the model withdrawn. A bell shaped portion of sand is next cut out, leading from the outlet of the mould, down to the impression around which a slight groove is cut leading into the outlet of the mould and smaller fissures are also made extending from the sides of the impression into the groove around the same. This will allow for the escape of air or steam when the metal is poured into the mould. Before this is done, the surface of the sand should be smoked with burnt resin, and then the two halves of the mould properly secured in a wooden frame to prevent it from bursting apart when the metal is poured in.

The smoking of the sand impression improves the surface of the cast, making it brighter and cleaner.

For casting small objects in the precious metals a mould may be used composed of brickdust and plaster in the proportion of two of the former to one of the latter. This mould may be made in sections if found necessary. Care should be taken to allow for outlet of air, in a similar manner to that described for a casting in sand, in the double iron mould, and also to have a sufficient head of metal to prevent contraction in the small object to be cast. This mould must be thoroughly dried and made quite hot before pouring in the metal, and for this purpose, it can be secured with thin iron wire and placed over a Bunsen burner or into the fire for a few moments.

DESCRIPTION OF THE METALS USED FOR CASTING.

A list of the metals used for casting purposes has been previously mentioned, so it will only be necessary here to give a short description of their qualities and a few hints as to their usefulness in special cases.

Zinc is perhaps the most important of the coarser metals used in the dental laboratory, and takes the place of the brass and fusible metal models that were formerly used. Its melting point is about 775° F. When melting zinc, care must be taken that the metal does not become overheated, as it rapidly volatilizes giving off a yellowish-green flame. A little fat thrown on to the heated metal will assist in preventing this. It sometimes gets thick and difficult to pour; to restore it to a more fluid condition, Sal Ammoniac may be

thrown into the ladle and stirred into the zinc with a piece of wood. Fletcher recommends Hydrochloric acid to be used for the same purpose; of this a small quantity is poured on to the melted metal at the same time stirring it with a stick. This separates the dross which floats on the surface. Zinc alloyed with tin makes a sharper die than zinc alone and there is less shrinkage, but if the zinc is alloyed with too high a percentage of tin it is liable to melt when dipped into the molten lead which is to form the counter-die.

Lead is the metal most used for counter-dies, its melting point is about 617° F. It unites with tin in all proportions forming what is known as soft solder and pewter.

It is not an uncommon occurrence in the workroom for the lead and zinc to become mixed owing to using the wrong ladle.

The two metals may be separated in the following manner. Build up a good deep bed of sand in the box, then make holes six or seven inches long in it with the handle of a file or a ruler.

The contaminated metal is then melted and poured into the holes so made, and allowed to harden, on removing these casts from the sand a line of demarkation will be found where the two metals join, this can then be cut across and the metals are separated.

The lead, being the heavier metal of the two, sinks to the bottom.

If lead is present in a zinc cast, it will be found to occupy the teeth and more prominent surface of the alveolar ridge, thus rendering the cast useless.

Another way for removing lead from zinc is to take the

contaminated model, make it sufficiently hot in a ladle to melt the lead, then remove from the ladle and wipe the melted lead from the model with a rag.

Tin is another most useful metal in the laboratory—melting point is 450° F. It is often used as a counter-die to give the finishing touch to a plate after it has been swaged up in the lead counter, it drives the metal home more sharply on the model and by some dentists is used in lieu of chasing the plate with punches. It is one of the component parts of fusible metal.

A piece of pure tin emits a peculiar crackling sound when bent.

It is also one of the constituents of type metal.

Antimony (melting point, 840° F.) is principally used in the manufacture of type metal; like Bismuth it expands on cooling.

Type metal is an alloy of Antimony, the preparations being 5 to 8 parts lead—1 antimony and 1-50th block tin.

Or another formula $\frac{1}{7}$ antimony, $\frac{6}{7}$ lead, or 3 parts lead, antimony one.

When making these alloys the metals should be melted in the order of their fusibility, that is to say the metal having the highest fusing point should be melted first and then the others added, and the whole stirred with a piece of wood and poured either into a mould or other convenient form.

Type metal on account of its fusibility, its hardness, and the sharpness of outline it gives to a cast, is frequently used to make a small die and counter for those cases where one has to stamp up a small piece of metal, such as for repairs, for adding a tooth to a case, or for strengthening.

For this purpose it may be melted in an iron pot, or in a small crucible over the flame of a Bunsen burner.

For these small plates an impression is taken of the surface to which the plate is to be adapted in composition, this impression can be built up with plaster so that it can be readily cast in sand—this is to form the counter-die. Into this impression another soft piece of composition is pressed, this is to form the die, and it has to be built up with plaster the same as the counter-die. These are then cast in sand so that the die and counter-die are formed at one operation.

Copper, melting point about 2000° Fahr.

Before the introduction of zinc for dental dies, an alloy of copper and zinc called brass was used for this purpose.

Brass is composed of about two thirds copper and one third zinc ; a small percentage of lead is said to improve it.

Brass may be melted and poured the same as zinc, that is in the ordinary sand used for the purpose, but it is as well if one wishes to get the best results, to have a good head of metal for the die to contract from. This can be effected by placing another casting ring full of sand on to the one containing the model, and cutting a bell-shaped cavity in the upper ring tapering down until it comes to the back of the plaster model. The model is then removed and the upper ring adjusted to the lower and securely cemented to it by sand, the melted brass can then be poured through the opening on to the sand impression, and when hard and the casting removed and cooled, the bell-shaped piece of brass may be sawn off. It must be mentioned that the sand impression should be smoked, and a good carbon surface produced on it by burning resin. This greatly improves the surface of the

casting. Brass models or moulds if required are much more economically produced by sending them to a brass foundry and getting them cast in fine brass at so much per lb.

There are other alloys of copper such as gun metal, bell metal, speculum metal, etc., but they are not frequently used in the Dental laboratory.

Copper used as an alloy for gold, increases the hardness of the latter, and in certain proportions forms what is known as spring gold.

It also imparts a reddish colour to the noble metal.

Meter Metal.—This is composed of tin, antimony, and lead, it is used in the dental laboratory for making matrix and polishing plates. It possesses certain valuable properties that enable it to be blown up in the steam swager, (see section on Vulcanite Work.)

With this machine steam pressure can be brought to bear on a thin diaphragm of this metal, and being brought to its softest condition by the heat of the steam, it is gradually forced up on to the surface of a model placed in the upper part, and accurately copies and adapts itself to its surface. The scraps of this metal that are cut from the swaged plate, should be saved ; they may either be remelted, or used for small castings, for which the metal is very suitable. Owing to its fusibility, it may be melted over a Bunsen burner.

Babbitt metal is a patent alloy of copper, tin, and antimony. The best formula is stated to be that of Dr. Haskell, which consists of Cu. 1 part, An. 2 parts, Sn. 8 parts. This alloy is nearly as hard as zinc and has less shrinkage. It is used to finish the swaging of a plate after being nearly completed on the zinc model. As this alloy fuses at a lower tempera-

ture than lead, it is necessary to have a counter die in which Sn. forms a part, such as Pb 5, Sn 1. The die should also be quite cold and covered with a coating of whiting, before inserting it in the molten metal.

In making the alloy the Cu. is first melted, then the antimony and tin added.

Cast Iron. Melting point about 2057 Fahr.

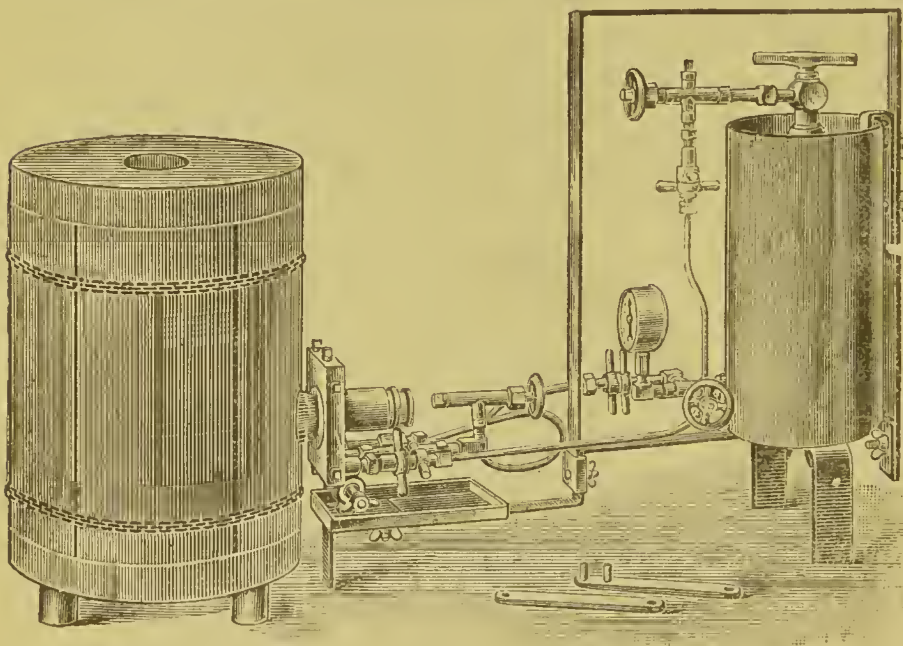


Fig. 50.

This metal has too high a fusing point to come into general use in the dental workroom for the purpose of making dies for swaging up plates, although the small amount of contraction it undergoes in comparison with zinc, seems to mark it as the ideal material for this purpose.

Mr. Fletcher explains in his Metallurgy how it may be

cast by the dentist the same as ordinary zinc metal, and further states that one iron die would be alone necessary as against the two or perhaps three generally used in zinc.

That it can be utilized for this purpose the author has proved, having successfully cast iron dies, melting the cast iron in the furnace described and illustrated in the earlier part of this treatise.

It can be melted readily in Fletcher's injector furnace, and a large quantity can be fused, say eighteen or twenty pounds, in one of Nelson's furnaces using the Petroleum Blast, in about half an hour. (See Fig. 50). There is not the slightest doubt that better results could be obtained by sending

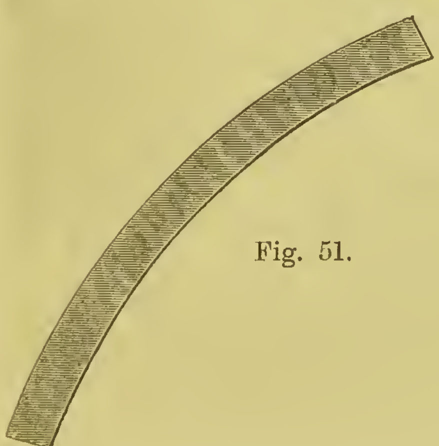


Fig. 51.

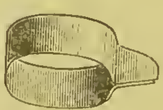


Fig. 52.

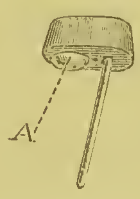


Fig. 53.

the model to the iron founders, but as time is often an object in dental work, it would render this latter a serious disadvantage.

During the process of melting, the surface of the metal should be covered by a layer of charcoal or sawdust to prevent oxidation.

For further information on this subject the student may

read with advantage the article on cast-iron in the work previously referred to.

It might perhaps be mentioned here that the contraction in a zinc cast may be regarded as an advantage, inasmuch as it, to an extent, counteracts the effects of the expansion of the plaster model.

Instead of padding the zinc model to counteract this, it has been the author's custom to try the plate in the mouth, utilising it at the same time for obtaining a correct articulation, and he has found as a rule, that the gum, not like the rigid plaster model—yields sufficiently to allow of the plate going perfectly home, the contraction in the zinc making if anything a tighter fit.

If after trying the plate in the mouth this fact is established it only remains to trim a little from the plaster model to allow the plate to go into its place.

Bismuth, fusing point 466 F. is a most useful metal inasmuch as it readily mixes with lead and tin, and forms a class of alloys known as fusible metal. Of these the two following are the most important.

The first is known as Newton's fusible metal and is composed of Bismuth eight parts, lead five parts, and tin three parts, and fuses at 202 F. just ten degrees below the boiling point of water, in which it may be melted prior to using. Dalton's fusible metal fuses at a still lower temperature namely 197 F. and is composed of Bismuth ten and a half parts, lead five, and tin three parts. The addition of Bismuth to lead and tin alters the character of both these metals, rendering them more brittle; the alloys also expand considerably

on cooling. Solder, pewter, and other alloys used in the arts, contain Bismuth.

It is much used for making patterns or castings of such small objects as teeth when extreme sharpness of outline is necessary. It may also be used for making the patterns for an artificial velum.

By duplicating the gutta percha patterns of the velum after adjustment to the mouth, in fusible metal, one is enabled to file up and produce much neater patterns from which to cast the mould in which the soft rubber velum is to be vulcanized.

In a very interesting and instructive paper read before the British Dental Association in 1891, Mr. R. P. Lennox of Cambridge, drew attention to a number of uses for this alloy.

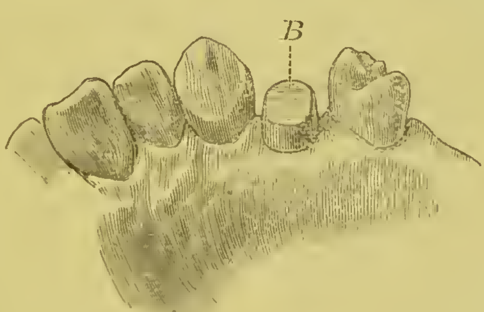


Fig. 54.

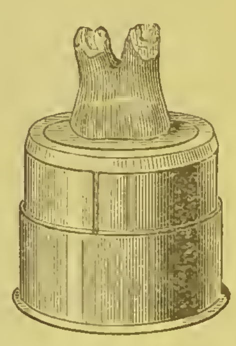


Fig. 55.

First, as regards crown work. In this class of work the metal may be used, (1) to make a mandril for shaping the ferrule, (2) as a setting for a natural tooth to be used as a die for striking up crowns, (3) as a means of obtaining an extremely well-defined and not readily damaged cast of the mouth when a tooth is to be pivotted.

By referring to the illustrations very kindly lent by Messrs

Ash & Sons, to whom I am also indebted for the directions for working, it will be seen very clearly how the different operations are carried out.

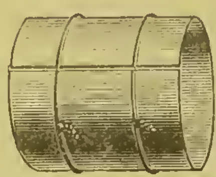


Fig. 56.

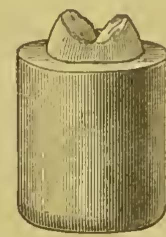


Fig. 57.

Fig. 51. Strip of copper cut to shape, for measuring the natural root, and obtaining a maudril for shaping the collar.

Fig 52. The same after removal from the root.

Fig. 53. Mandril obtained from fig. 2 with pin and boss A.

Fig. 54. Shows Fig. 53 in situ at B on the plaster model, ready for use in shaping the gold collar to which the crown is to be soldered.

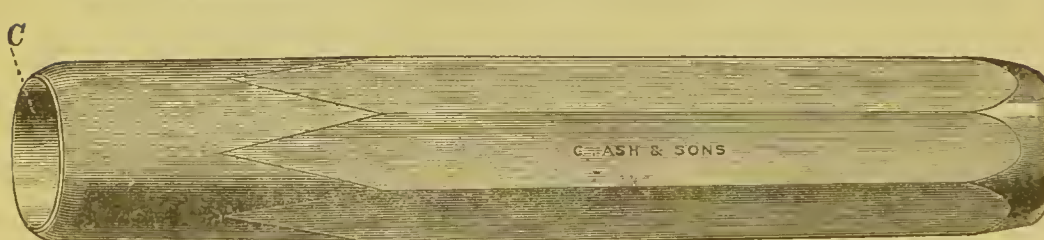


Fig. 58.

Fig 55. Shows mould A holding a split copper ring filled with King's Crown composition, in which is embedded a natural tooth crown downwards.

Fig. 56. Shows a second split copper ring which is placed over the tooth in fig 55, and into which fusible metal is poured from the cup, fig. 59.

Fig. 57. Shows the crown die thus produced.

Fig. 58. Steel Punch drilled out at C to receive Crown die Fig. 57.

Fig. 60. Shows a method of securing the crown to the collar by means of a piece of binding wire for the purpose of soldering.

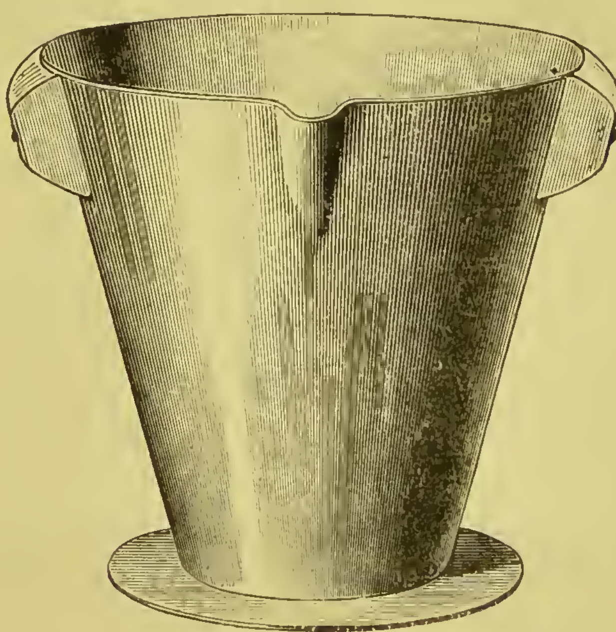


Fig. 59.

Fig. 61. Pair of pliers for grasping and bending copper strip around molar teeth.

Second. For making an articulator. It is claimed that this possesses many advantages over the old plaster slab bite which it is meant to replace. Directions for making the articulator. Trim the models so that, when articulated, their backs will sit comfortably in the square tray (Fig. 62). Fix the small oval tray (Fig 63) by means of the split tube and

disc (Fig 64) in the centre of the tray (Fig 62) trim the models and adjust the tray (Fig 62) so that it will pass between the models.

If using the tray for the first time paint all the interior with rouge and water.

Fig. 60.

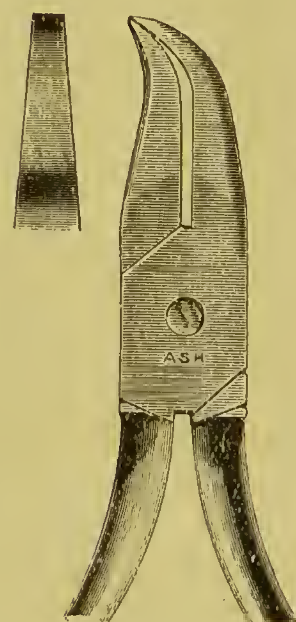


Fig. 61.

Place the square tray (Fig 62) in a shallow pan of water, put in as much fusible metal as will when melted, from a half to three parts fill it. Make the water boil, and when the metal is melted, remove the tray from the pan, pour away the hot water, replace the tray in the empty pan, insert the model in the molten metal, and pour cold water into the pan to hasten the cooling.

Remove the models, and the split tube and disc (Fig 64), turn out the slab from the tray (Fig 68) and push out the small oval tray from the centre.

Of course the backs of the models must be so trimmed or made up with clay before investing as to be capable of removal from the metal slabs (see Figs 65 and 66.)

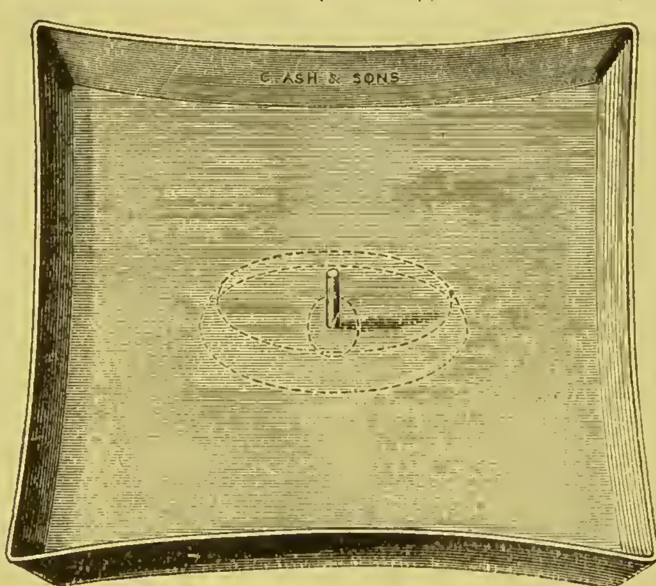


Fig. 62.

Third. Mr. Lennox uses this metal to form a base plate on which to mount composition for obtaining the articulation

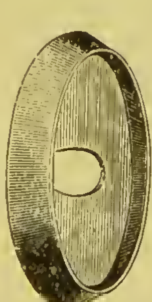


Fig. 63.

Fig. 64.

or bite, and also for mounting the teeth up in wax, and trying the case in the mouth. For both these purposes the rigidity and fit of the plate makes it peculiarly suitable. In

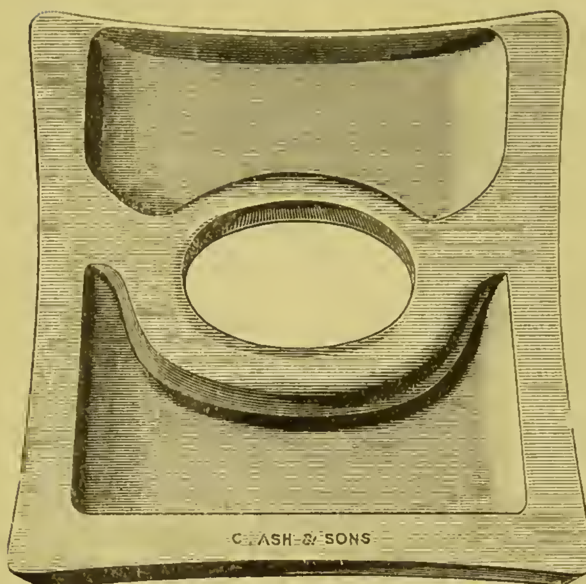


Fig. 65.

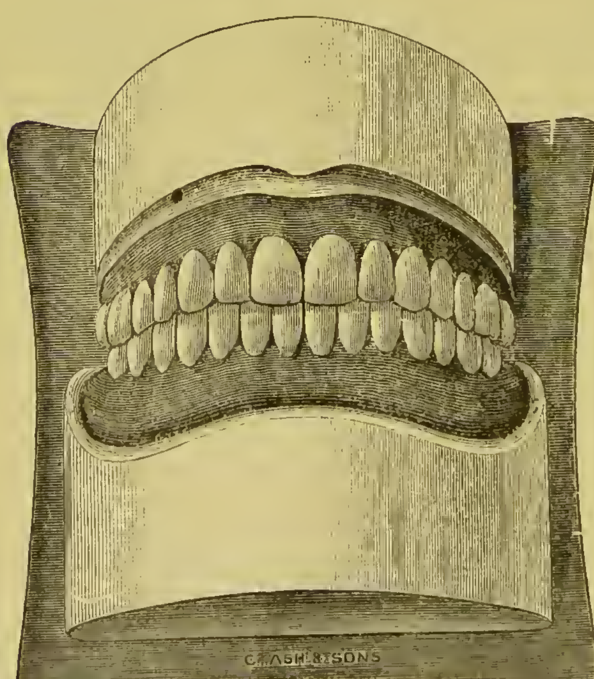


Fig. 66.

the first operation, that of getting the bite, the primary object to insist on is that the plate can, after the operation in the mouth is finished, be replaced again on the model, in as perfect a condition (that is as good a fit) as it was at first.

He describes the process as follows :—A wax plate is fitted to the usual plaster model and trimmed to the size of the desired metal plate. The wax is then French chalked, and thickly covered with King's Crown Composition. When this is set the wax is removed, and fusible metal poured in to takes its place.

For the various other purposes for which this fusible alloy can be utilised, the author would recommend the reader to the paper on the subject, or to the clear and concise descriptions in Ash's Quarterly of March, 1895.

DENTAL MECHANICS.

PART III.

Plate Work.

BY

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WITH NUMEROUS ORIGINAL ILLUSTRATIONS.

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INDEX.

DENTAL MECHANICS:

PLATE WORK.

Preparation of the Materials for Plate Work.

The subject of plate work, comprising as it does not only what is understood by the ordinary gold denture, but all such appliances as crowns, bridges, and pivots, or in fact any work where gold is used in the form of wire, or plate, necessitates such an insight into the character and behaviour of metals, that it is obligatory on the part of the practical dentist that he should have a fair knowledge of this interesting and useful art.

Taking, therefore, such an extended view of the subject, we will in the following pages, endeavour to make the student clearly understand the various means by which he can prepare the precious metals, by refining, alloying, melting, rolling, and drawing into wire the various qualities of both plate and solder that he is called upon to use.

Nothing to the author's mind shows more the helplessness of the student or young practitioner, than his having to send out for everything he requires to use.

A want of this knowledge places him, so to speak, in a state of dependence, and is a practical admission that he is only conversant with half his profession. As an introduction therefore, to the subject of Plate-work, we will call the reader's attention to a few remarks on the subject of Metallurgy, or rather that part of it which deals with the preparation of the precious metals and their alloys.

Gold, silver, and platinum are the only precious metals in general use in the dental workroom.

The first-named, gold, is the only simple metal of a yellow colour ; it is the most malleable of all metals, and can be drawn into wire of exceeding fineness, or beaten into sheets so thin that it is said one grain will cover a surface of 50 square inches.

For dental work it is seldom used in a state of purity, being in that condition too soft; it is therefore usually alloyed either with silver or copper.

The addition of silver to gold does not interfere with its malleability, but changes its colour, making it paler and giving it somewhat of a greenish tint. The addition of copper, on the other hand, renders it harder, more springy, and gives it a reddish colour.

Silver in its pure state is also too soft to use for dental plates, and when alloyed has the further disadvantage that it tarnishes and becomes in a short time quite black in presence of the oral secretions, owing to its strong affinity for sulphur. When in combination with a good percentage of platinum it forms a very useful metal, known as Dental Alloy, which can be used for dentures when a cheaper material than gold is required.

In other respects this alloy possesses all the qualities of a

gold plate, inasmuch as it resists chemical changes in the mouth, does not tarnish more than 18 carat gold plate, and is perfectly free from any disagreeable metallic taste. It has an advantage over pure platinum, inasmuch as it is not nearly so heavy.

The use of platinum as a base plate is usually restricted to Continuous Gum Work, it being the only metal that will stand the necessary heat required to fire a piece of this work.

How to prepare fine gold.—This may be accomplished either by the dry or the wet method ; the dry process is called cupellation, and is a very ancient metallurgical operation. A small cup or dish, called a cupel,is formed by making well burned and finely ground bone ash into a paste, and pressing it into a mould, to the desired shape, and it is then thoroughly dried.

It is afterwards placed in a muffle, somewhat like those used for Continuous Gum Work, or making teeth, with the exception that it is perforated by a number of holes in the sides and back. The muffle is placed in a suitable furnace, and made red hot, and then the gold to which has been added about three times its weight of silver, is wrapped up in sheet lead and laid upon the cupel; the whole is then heated. The lead melts and oxidizes, gives up oxygen to the inferior metals in the alloy, and the excess of lead fusing dissolves the oxides of the other metals and sinks with them into the cupel. The operation is continued until the whole of the lead has disappeared, and a bright mass of gold and silver is left behind. The button of gold and silver alloy is now taken and rolled or hammered out quite thin ; it is then annealed, that is, made red hot, and curled round in a spiral form, into what is known as a cornet.

This latter is now put into a flask with nitric acid, which dissolves away the silver, and leaves the cornet dark and brittle, it is then washed with water and again boiled with nitric acid to dissolve out the last trace of silver, and then washed and dried ; it can now be weighed and afterwards melted in a fireclay or plumbago crucible with a little borax.

To the solution left, which is silver nitrate, sodium chloride (common salt) is added, which throws down a precipitate which is silver chloride.

The precipitate should be allowed to settle for an hour or so at the bottom of the vessel, and then the liquid may be poured off. The precipitate should next be repeatedly washed with hot water to get rid of the nitric acid, after which it can be dried and fused in a crucible with Pot. carb.

If it is desired to convert the silver chloride into metallic silver, it may be done in the following manner. The chloride after washing should be placed in a porcelain dish, and evaporated nearly to dryness. A number of pieces of iron wire are then taken and pressed into the semi-hard chloride, the same as one would stick pins in a pincushion, and then the chloride is acidulated by the addition of a small quantity of dilute hydrochloric acid. The vessel containing the chloride should not be stirred, but placed on one side for twenty-four hours, when the whole will be found to be converted into metallic silver.

The pieces of iron, or rather what remains of them, are removed and the silver should be well washed with Hydrochloric acid, to remove all traces of iron.

To make sure that iron is not present one ought not to get a blue precipitate by the addition of Ferro-Cyanide of Potassium to the washings.

The metallic silver is now to be dried and mixed with about twice its weight of Pot. Carb., and melted, when it can either be allowed to cool at the bottom of the pot, or it may be poured into a tub of clean cold water, agitating the water with a stick, while so doing. This will form it into grains such as are bought at the refiners.

The preparation of fine silver is effected in the same way as that for gold, the silver being wrapped in lead foil and placed in a cupel and the whole heated until a bright, clear mass of silver is left behind. It may also be prepared by the wet method by dissolving in nitric acid and precipitating with common salt.

To prevent the loss of silver owing to the spitting, and also to the absorption of the fused chloride by the crucible, Fletcher in his work on Metallurgy, recommends mixing the chloride of silver with finely powdered resin in the proportion of 3 of the former to one of the latter. Heat the mixture slowly, until flames cease to be given off and then raise to the melting point of silver, adding a little borax.

To prepare fine gold by the Aqua Regia process.

By the nitric acid process one is enabled to separate all impurities from gold, with the exception of platinum. If our object is to remove traces of this metal we proceed in the following manner :—

Melt and roll the gold very thin, and place in a glass flask. Next make a mixture of about two and a half parts of hydrochloric acid and one part nitric acid, and pour on to the gold to be refined. The flask containing the gold and acid, should be placed in a sand bath, and heated in such a position that the dense fumes may be carried up the chimney. These acids

attack and dissolve out the gold and platinum and leave the silver at the bottom as silver chloride.

This should be separated from the gold and platinum solution by pouring it on to a filtering paper; it can then be dried and weighed.

The solution containing the gold and platinum is now evaporated nearly to dryness, and hydrochloric acid added to it to get rid of the free nitric acid. It is then evaporated a second time and afterwards diluted with a large quantity of water. To this solution is now added, a little at a time, protosulphate of iron, which will precipitate the gold as a brown powder ; this may also be separated from the solution by filtration and afterwards washed in sulphuric acid to get rid of any traces of iron.

To the solution left we now add ammonia chloride, which will throw down the platinum as a yellow precipitate. This is of no use to the dentist, unless used as a colouring matter, and should be sold.

The gold may also be precipitated from its solution by oxalic acid. When this is added to the gold solution it should be placed on one side for twenty-four hours, and the precipitate dried ; then made red hot to drive off the oxalic acid.

The gold precipitate may now be melted in a crucible with a little borax.

Preparation of Gold Plate :—To make 16 carat gold plate, take—

Fine gold	...	16 parts
do. silver	...	5 ,,
Pure copper	...	3 ,,

18 carat	Fine gold	...	18 parts
	do. silver	...	4 „
	Pure copper	...	2 „
20 carat	Fine gold	...	20 parts
	do. silver	...	2 „
	Pure copper	...	2 „
22 carat	Fine gold	...	22 parts
	Pure copper	..	2 „

These materials should be obtained from the refiners, the copper being either in the form of wire or electrotype.

Another method of preparing gold plate is to use the ordinary gold coin of the realm. This is of 22 carats fineness, and from its known quality and toughness is always reliable for alloying purposes. The English sovereign weighs 5 dwt., 3¼ grs., and contains 113 grains of pure gold.

To reduce sovereigns to 16 carat gold, we must add to each coin 46 grains of alloy.

For 18 carat gold 27½ grains of alloy. And for 20 carat gold 12½ grains.*

Coin silver may be used as the alloy, but it is rather a wasteful method ; equally good results are obtained by using fine silver, at about half the cost of the first-named. The gold will be found quite hard enough for all practical purposes.

To make hard or spring gold.—This is made by adding, say to 16 parts of fine gold, 4 parts of copper, and 4 parts of

* Fletcher's Dental Metallurgy.

silver. This alloy should be melted first, and then added in the proper proportion to the gold.

Hard gold is used for making clasps, the ordinary 16 or 18 carat gold being too soft for that purpose.

The addition of a small quantity of platinum also makes gold hard and springy, but for all practical purposes the addition of copper is sufficient.

Method of refining gold by heat.

If the gold to be refined is in the shape of filings, a magnet may be passed through them several times to collect and remove the iron that is usually found in them.

The filings may now be treated by boiling them out in Nitric Acid; this will still further remove the base metals. After the acid is poured off, and the filings washed and dried, they may be placed in a skittle pot (see Fig 1) after being mixed with about double the weight of Pot. Carb., and a few pieces of Pot. Nitrate.

The pot is now warmed up and inserted in the furnace, and subjected to a strong heat for about an hour.

If in the course of melting, the contents of the skittle pot show a disposition to boil over, a little Sodium Chloride (common salt) thrown in from time to time, will cause them to subside.

After having subjected the pot to heat for the time named, it should be removed from the fire and placed on the hearth to cool somewhat, after which it may be more rapidly cooled by pouring cold water into it.

The pot may now be broken up, and the button of gold which will be found at the bottom removed and cleaned from flux.

If the gold has not had sufficient heat to fuse and

collect it properly, instead of being found in one clean round mass it will be found scattered about the pot in particles ; in this latter case, the contents of the pot should be collected and remelted.

When the button of gold has been thus freed from adherent flux, it should be remelted in a black lead pot (Fig 2) with a little borax, and covered over whilst melting. Small pieces of Pot. Nitrate should be thrown in from time to time, taking care to recover the pot. When the gold has been subjected to considerable heat for half an hour it may be poured into a suitable ingot mould which has been previously warmed and oiled. The ingot of gold should now be hammered at the ends, and then rolled. The object of hammering the ends is to spread the fibres of the metal and prevent the edges from cracking. Should it crack or exhibit any defects, it must be remelted in a clean pot with borax, using more Pot. Nitrate thrown in as before. This process will in the majority of cases toughen and refine the gold and make it workable.

To ascertain its quality a small piece say 20 grs. may be taken and dissolved in Aqua Regia. The silver will be left as chloride at the bottom of the flask ; this may be dried and weighed. The gold solution should then be treated with $Fe\ So_4$ which will throw down the gold, and to the solution left after separation from the gold add ammonia chloride, which will throw down Platinum, if present. By this means the quality of the gold can be ascertained, at any rate sufficiently so for the practical purposes of Dentistry.

If the gold to be melted is in the form of scraps it will only require borax as a flux to melt it, and Pot. Nitrate thrown in whilst melting, to make it tough, each time re-covering the pot. If after subjecting the gold to a strong heat for half an

hour and looking into the pot, the surface of the melted gold appears clean like a mirror, and free from impurities which would otherwise cloud and scintillate over its surface, the pot may be taken out of the furnace and the gold poured into a mould previously warmed and oiled. Should it not prove tough it must be remelted, and submitted to the same process as before, giving it a more prolonged heat.

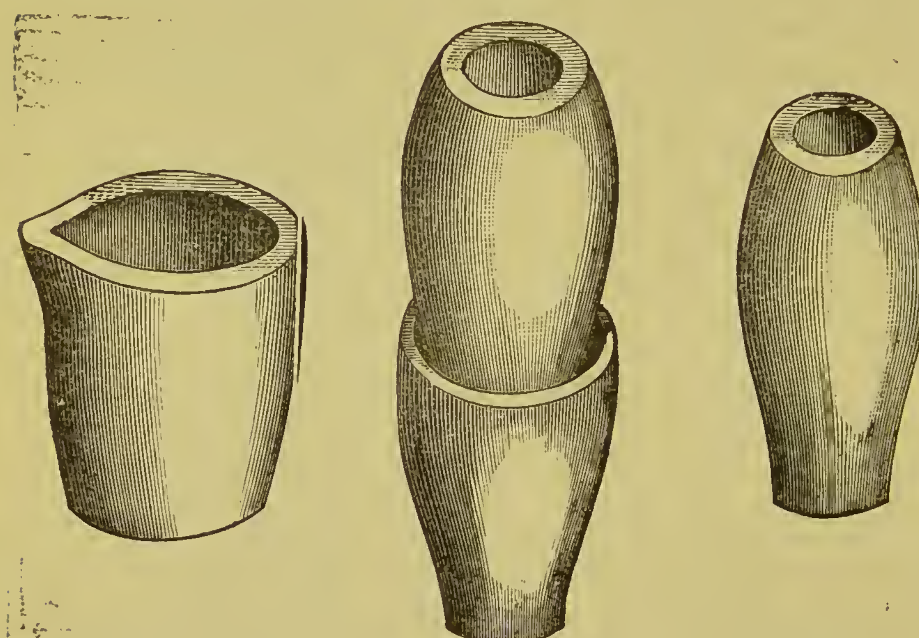

Fig. 2. Fig. 3. Fig. 1.

Sometimes it may be necessary to treat the melted gold with corrosive sublimate (bi-chloride of mercury) or sal ammoniac (ammonia chloride). The chlorine is the active agent in this latter case for removing the impurities in gold.

Preparation of the furnace for melting. Before the fire is lighted, an old crucible or half a fire brick should be placed in the centre of, and on the bars at the bottom of the furnace, in order to form a foundation for the pot containing the gold

or other metals,to rest upon. The fire is then lighted with wood and coal in the ordinary way, and when a clear fire is pro duced up to, or slightly above, the edge of the fire brick, the pot containing the metal should be placed in position, so as to rest on the fire - brick, and then the furnace filled up either with gas coke, or a harder and heavier coke made from anthracite coal, called foundry coke, which gives a greater and more lasting heat than the former, but which requires a good draught for its thorough combustion. A very good method is to mix the two kinds of coke; the object of having this sort of fuel is that the furnace does not require replenishing so often.

When melting gold in a skittle, or ordinary fire-clay pot, it is as well to insert it into another one, (Fig. 3). This protects the pot containing the metal, and is also a precaution in case it should crack, and its contents run out. In such a case the gold would run into the bottom pot instead of into the fire. With a plumbago or black-lead pot, the bottom pot may be omitted, as these pots are not likely to crack if treated with ordinary care in heating up, before inserting into the furnace. These pots therefore, are the safest to use.

If it is desired to dispense with a bottom pot, the ordinary skittle pots may have a luting composed of "fire-clay, pounded baked clay and hay" plastered over the lower two thirds. The pots when luted are placed in a warm place, and allowed to dry for some time before being used; this investment protects them from sudden changes of temperatures, thereby avoiding cracking.

When melting it is essential to have all ashes or rubbish removed from under the furnace, for if by accident, or other

cause, the pot breaks or gets upset, there is that amount less of rubbish to extract it from.

Should such an accident happen, the contents of the furnace must be carefully cleared out, and, together with the broken pot, pounded up in an iron mortar, until all is reduced to a fine powder. A portion of this should now be placed in a tin bowl, and have water added to it. After stirring up, the water is more gently agitated, and the finer particles of dirt washed away, more water is added and the process repeated until the dirt is washed away. All the material is served in the same manner, and after this washing the remainder is pounded and again washed, when ultimately there will remain at the bottom of the bowl the lost gold contaminated with the heavier portions of rubbish that will not wash off.

If this operation is done carefully and the rubbish reduced to a fine powder, nearly all the gold will be recovered ; it should be mixed with Pot. Carb., and remelted in a skittle pot and either refined again or sold.

Dental Alloy.

This is an alloy of platinum and silver, and is prepared in the following manner,—

Take one ounce of platinum in the form of foil, and cut into thin strips; add to this two ounces of either fine or coin silver. Place the silver at the bottom of the crucible (black lead pot,) and the platinum foil on top, so that when the silver melts the platinum may pass into it. Platinum being the heavier of the two metals, when melted it should be stirred with the stem of a tobacco pipe ; it requires a good heat to melt it, and must then be poured into the mould very quickly. The principal thing to observe in melting

dental alloy, is to see that all the platinum is thoroughly incorporated with the silver ; to ensure this an excess of platinum may be used, as silver will only take up a certain quantity. When making new dental alloy only a small quantity of borax need be used as a flux.

Dental alloy filings, or old scraps, may be melted and refined like gold, using saltpetre in the same way to make it tough. If platinum in the form of scrap, pins of teeth, &c., is used in the place of foil, greater care must be observed in melting it, in fact it requires to be remelted once or twice in order to get a thorough incorporation with the silver.

The preparation of gold solders.

The following list shows the composition of various solders.

17 CARAT.	Fine Gold	10 parts.		Coin Gold	13	parts.
	„ Silver	1½ „		Silver	2	„
	„ Copper	2 „		Copper	1½	„
	„ Zinc	½ „		Zinc	½	„

16 CARAT.	Fine Gold	8 parts.		Coin Gold	10½	parts.
	„ Silver	1½ „		Fine Silver	1½	„
	„ Copper	2 „		Copper	2	„
	„ Zinc	½ „		Zinc	½	„

14 CARAT.	Fine Gold	6 parts.		Coin Gold	8	parts.
	„ Silver	1½ „		Fine Silver	1½	„
	„ Copper	2 „		Copper	2	„
	„ Zinc	½ „		Zinc	½	„

16 CARAT.	Fine Gold	30	parts.
	,, Silver	8	,,
	,, Brass	7	,,

SILVER SOLDER.	Fine Silver	10	parts.
	,, Brass	$2\frac{1}{2}$	,,
	,, Zinc	$1\frac{1}{2}$	,,

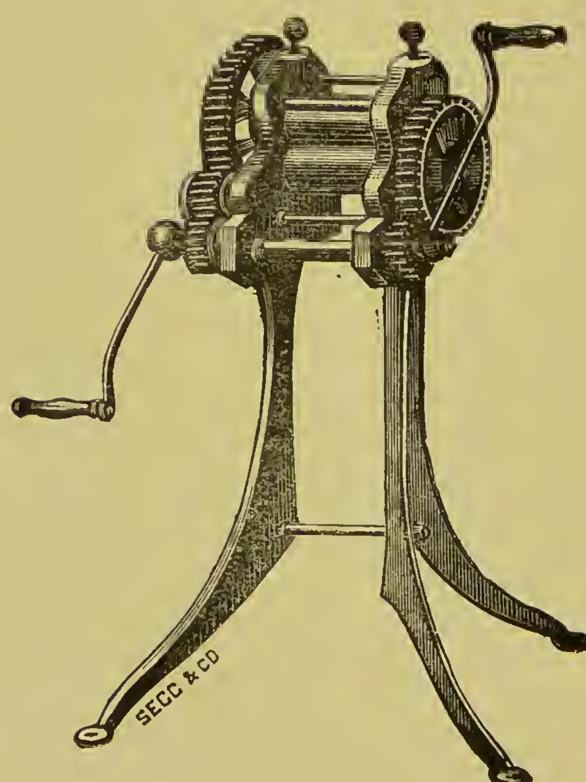

Fig. 4.

When making solder, the three metals, gold, silver and copper should be melted first, using for the purpose a clean fireclay crucible.

When in a state of fusion the remaining ingredient zinc is added, but to prevent immediate volatilization when it comes in contact with the molten metal, it should be wrapped up in a little gold foil, and inserted into the crucible by means of a pair of tongs; the contents of the pot should then be immediately stirred with a tobacco pipe stem, previously made warm, so as to thoroughly mix the zinc with the other metals.

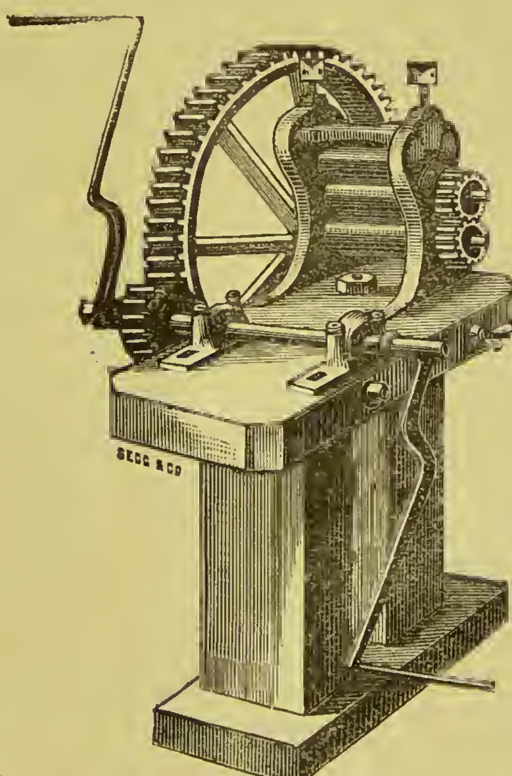

Fig. 5.

After remaining in a molten condition in the fire for a few moments, it may be poured into a suitable ingot mould previously warmed and oiled. It has now to be flattened or rolled, in the same manner as described for gold.

The rolling is accomplished by means of the flatting mills or rollers as shown in figures 4 and 5.

The space between the rollers which are made of hard, polished steel, is regulated by two set screws, which on being tightened after each introduction of the metal between them, reduces the gold or other metal to the required thickness, which may be ascertained by means of a guage-plate.

The guage-plate is a thin plate of steel having recesses cut in it, corresponding in width to certain standard thicknesses of metal ; these are numbered respectively 5.6.7.8.9. etc.

The rollers during and after use should be kept well oiled and free from dirt or grit, and care should also be taken that no flux is adherent to the metal before placing it between the rollers. If the piece of metal is to be made into wire it should be rolled until it is about $\frac{1}{8}$ of an inch thick, or a little larger than the thickness of wire required, then annealed, and afterwards cut into strips $\frac{1}{8}$ square, by means of a pair of large shears placed in the vice.

The strips ought to be cut in the same direction as the gold was rolled, and before bending them straight, they should be annealed again.

It is usual also after straightening to smooth the edges of the strips somewhat, either with a file, or by hammering, and then one end is filed to a point to enable it to be inserted in the draw plate, for reduction to the proper size.

The draw plate (see section in "The Dental Laboratory,")is a steel plate about a quarter of an inch thick, perforated by a number of holes, gradually diminishing in size, through which the wire is drawn ; the latter should be annealed at every third or fourth hole.

The drawplate when being used may either be placed in a

vice, or on a draw-bench. If the plate is fixed in a vice a pair of large pliers, or draw-tongs, may be used to pull it through the holes.

The draw-bench (fig 6) can be used when one has to draw thick wire.

With this bench, fairly thick wire can be drawn down with the expenditure of only a slight amount of labour-force, by means of the powerful arms seen on the left side of the figure.

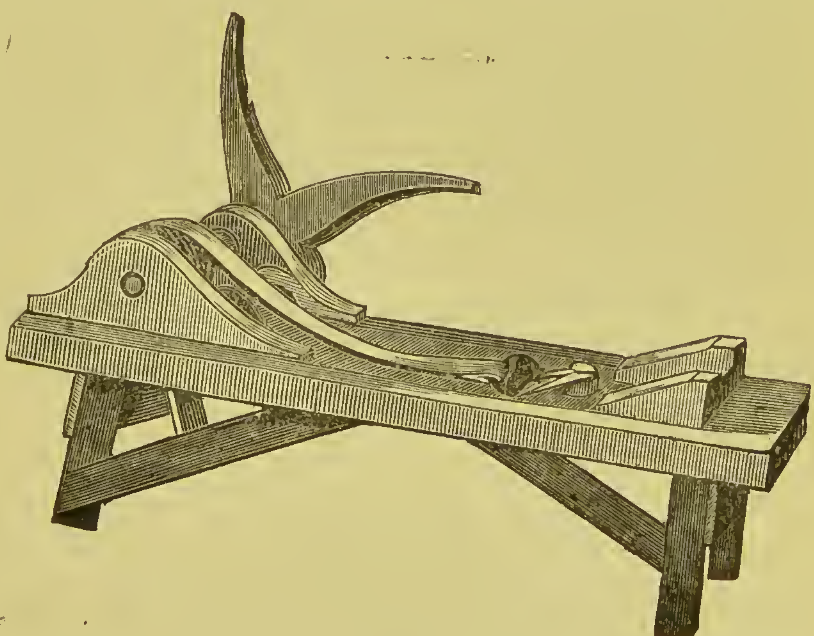

Fig. 6.

These arms are connected with a spindle, around which is wound a thick leathern band. To the free end of this band is attached the handles of a strong pair of draw-tongs.

The draw plate is placed at the back of and against the two buttresses formed by the two pieces of wood on the right of the figure and the draw-tongs are pushed in between the

buttresses and made to grasp the wire as it is pushed through the draw-plate.

As tension is made on the straps by turning the arms, the handles of the draw-tongs are brought together and the wire is then gripped very firmly and drawn through the plate.

Wire that would require enormous force to draw it through a plate fixed in the vice, may be drawn down with ease by means of this bench.

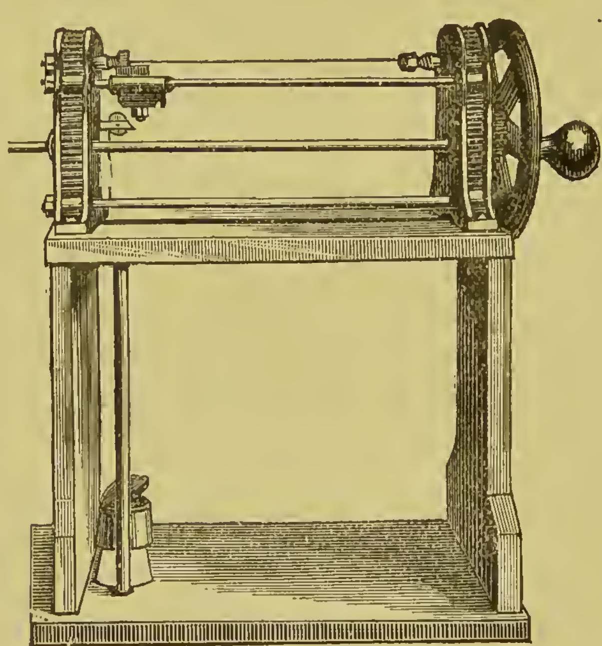

Fig. 7.

Before leaving this subject, it might be mentioned that when drawing long lengths of gold wire to make spiral springs, the wire after being pulled through the plate for a certain length may be coiled around a large wooden roller, and the further drawing proceeded with. In order to render the wire springy it is kept annealed to within the last five or six holes of the required thickness, after which it is left hard.

I am indebted to my friend, Mr. W. R. Humby for the following illustration of a machine for making springs. (Fig. 7.)

When proceeding to make springs, the end of the length of gold wire is first passed through an agate hole ' to burnish it ' and then carried upwards, the end fixed to the small chuck which carries the thin steel mandril, (represented by the top line of the diagram) on which the wire is wound. Tension is made on the wire by means of the weights shewn on the left of Fig. 7, and the handle on the right is to wind the wire on to the mandril. When a sufficient length of wire is coiled on the mandril, it is removed and then cut into lengths of the required size.

Springs range in strength from about No. 6 to 10 according to the thickness of wire used. Sixteen carat gold is usually employed for the best quality springs, and it must be of extreme toughness, or else it is unfitted for the purpose.

Gold Plate Work.

Before commencing the descriptive part of this subject one may be excused for saying a few words on the important part it takes in dental mechanics.

Those who have had the opportunity of observing, and examining, the work turned out by a large number of students extending over a considerable number of years, must have been struck by the fact, that gold plate work, which constitutes so to speak the very backbone of our mechanical art, the basis upon which its existence depends, and which enters into and forms the foundation of its most artistic efforts, is rapidly and surely deteriorating both in character and quality.

That this is so is much to be regretted, for it is this work

that gives the student the greatest opportunityfor the exercise of his mechanical ingenuity and manipulative skill; it also calls into play his inventive faculty to a greater extent than any other kind of work that he may be called upon to perform.

The falling off in the quality of the work may be put down to several causes. First, the advent of vulcanite ; this has in a great measure been the cause of the mischief, owing to the fact of its being more easily manipulated, and at the same time supplying the demand of the public for a less expensive denture.

Secondly, to the short period of pupilage now existing, namely three years or perhaps only two. It can thus easily be understood that the present student cannot possibly hope to compare with one who had served five or perhaps seven years. In the case of the older student, he not only had the opportunity to acquire all the details of his work, but he had time also for extensive and useful practice, thus enabling him to work well and rapidly, ready at the end of his time and fit to go into the world and earn his own living. Could one say this of the present short time student ? Nothing demonstrates more forcibly the old proverb that practice is better than theory, than does this branch of our art, and taking into consideration that one's success depends so much upon manipulative skill it certainly points out either the advisability of a longer course of dental mechanics, or that every effort should be made on the part of the practitioner that his pupil should cover the ground in the three years and get a fair insight into all the details of his work.

To attain this end it becomes necessary to proceed on a system, dividing the work up into sections or stages, and seeing that the pupil attains a fair proficiency in the details

of one, before he is advanced to the other. The pupil may with advantage devote the first six months of his time to plate work, using German Silver in the place of gold. This will not only teach him how to use the file, sculptor, saw, and other tools in a proper manner, but will also educate his hand so as to acquire the necessary delicacy yet firmness of touch, that distinguishes the trained dentist.

In preparing the models for casting, in making dies and counters, and in generally exercising himself in all the details of swaging plate and strengtheners, he will find the time well and profitably filled up.

During this period also, he may vary the programme by making small tools necessary for his work, such as drills, screwplate and taps, etc.

Backing teeth in the ordinary way, and also to produce a biting surface, fitting clasps to models to illustrate the varieties used for different teeth, and also in making swivels are useful exercises. He should also be enabled to acquire the art of alloying, melting, and refining gold in the rough and ready, though practical, way usually observed in the dental workroom, and we trust by a careful perusal of these pages, the student will be enabled to practically prepare many of the materials of which, in the future, his cases will be made.

If the student is well drilled in the details of plate-work, he is then able to bring a much more artistic mind to bear on the working of the more easy plastic materials, and to realise that he has to exercise as much care in the manipulation of the latter as in that of the former.

The next six months may be devoted not only to the making of plates but also to the fitting of teeth, both flats and tubes.

He may also with advantage, fit a number of bone blocks and be taught to carve the teeth up in a natural and artistic manner; this will enable him to educate his eye to the different surfaces of a plate, and after a time by practice he will be able to make an approximate fit either of a tooth or a block to a plate, without having recourse to red paint, except for the purpose of fine fitting. It will also teach him the relative position of teeth in different parts of the mouth. He ought at this stage to learn to discriminate between one tooth and another so that when mounting, he fixes them in their proper places. At this period also he should be taught the use of a bite or articulation, its object and how to make it efficient.

At the end of the first year he may vary his work by making combination cases, such as German Silver and vulcanite attachments for the teeth.

He may also make metal teeth, using an alloy of copper and silver, for short bites. These he can mould up in composition so as to make them fit both the bite and the plate and also have a fairly natural shape.

Then, in addition, we have the mounting of swivels to plates and mounting sets of teeth on wax and other base-plates. These latter need not of a necessity be vulcanized, but are only meant as studies, for the artistic arrangement of the teeth and to acquire neatness in moulding.

At the beginning of the third year, a study in crown-work may be added advantageously to his other duties, also the making of regulation cases, the methods of making obturators and artificial vela. The student should also now be given cases to make in the nobler metals, and undertake as large a variety of cases as possible.

Where it is possible, without the likelihood of injury resulting, the student should be encouraged to use his own discretion and judgment but if at all uncertain he ought to ask for information, and be encouraged to read all the literature he can on his mechanical studies.

Plate-work is made up of details, small in themselves yet conducing, if observed and carried out, to the production of a case with a perfect finish; from the beginning to the end of the work care must be observed, and each process carried out in an intelligent manner.

The student must be early made to understand and recognise that the first principle to grasp, is to learn to take care of the plaster model, for let the case be ever so well made, if the model has been rubbed, or abraded, during the process of fitting the plate and clasps, it will not fit the mouth.

Thus we begin with the preparation of the plaster model, and the means taken to preserve it from injury; on this the success of our work depends.

For vulcanite work the model is usually made as thin as possible consistent with strength, but for plate-work, it should be cast from one and a half to two inches deep; this is to ensure a fairly substantial zinc model, and also to avoid the risk of fracturing it, during the process of moulding in the sand. The sides of the model should also be bevelled, from the base to the alveolar borders, to permit of its ready withdrawal from the sand (Fig. 8).

The object of having stout zinc dies is to avoid the possibility of their splitting during the hammering incidental to the swaging process.

After trimming up the model, it should be placed on the

top of a stove, or other warm place, taking carc that it does not get overheated.

Should such an event happen the plaster is rendered soft and friable and is easily injured.

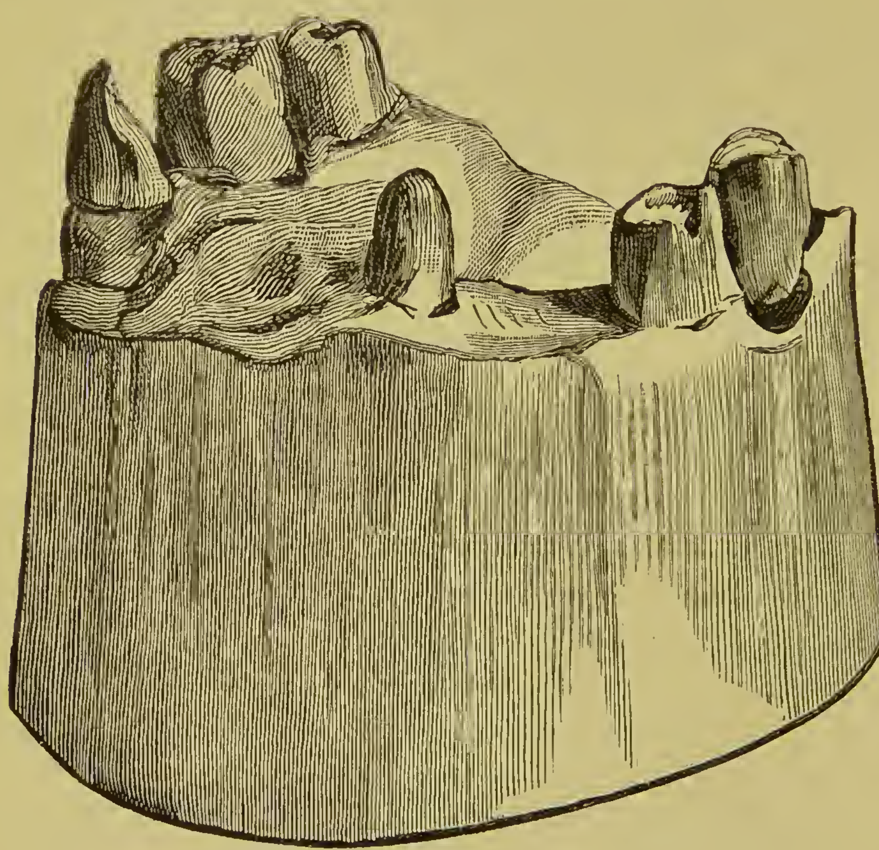

Fig. 8.

After drying, and while the model is still warm, it may either be varnished with brown spirit varnish, or boiled in stearine. A mixture of two-thirds bee's-wax and one-third resin may be used in the place of the stearine, but does not produce such a nice looking model, nor one so pleasant to handle.

The object of thus treating the plaster model is to still further lessen its liability to be rubbed.

At this stage the model may be further prepared if found necessary, by padding the various parts, that are likely to be rubbed down or flattened during the process of swaging. For instance, certain prominent parts of the alveolar ridge, such as the tuberosities, or deep rugæ in the palate, may have a thin film of wax melted on them, so that when

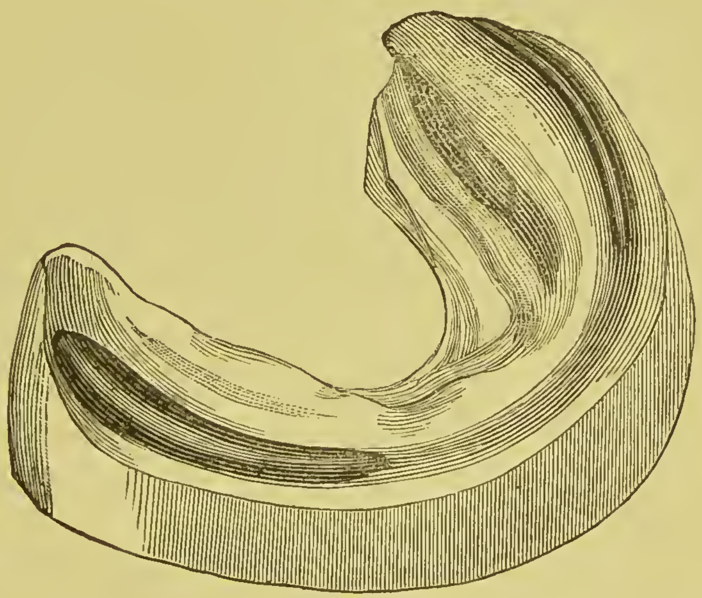

Fig. 9.

the model is cast the die will be slightly bolder in these situations than the original. A little padding may also be necessary around the necks of the teeth when the gum is depressed owing to a slight dragging ; and any undercuts at the necks of the teeth may be filled up with wax so as to ensure the model parting from the sand.

Lower models are also padded in the buccal, and hyoid

regions, to take off the pressure from the edge of the plate, as represented in Fig. 9.

After the plaster model has been prepared, in either of the foregoing ways, it is ready for casting in the sand.

As this process has been fully entered into in the section of this work entitled "The Dental Laboratory," it will be sufficient if we just mention here, that the model is taken and dusted with French chalk, then laid on the floor of the sand box, and a brass or iron ring placed around it. The sand having been previously damped sufficiently for it to hold together, is now sprinkled over the model, then pressed down on to it, and the mould completely filled up.

On reversing the mould the base of the model is exposed, and it may either be removed by tapping the bottom of the model, and letting it drop out, or it may have a steel point driven into the centre of it, then gently tapped, and lifted out at the same time.

When two or three of these sand impressions have been obtained, they are filled with melted zinc to make what are known as zinc models or dies.

These dies are now taken and any imperfections removed either with a file or sculptor ; they are then ready to be dipped into melted lead, previously poured into a vessel of a suitable form, so as to form a counter-die. These counter-dies can also be formed by sinking the zinc model in sand, leaving exposed only as much as is required to be sunk in the lead. A wrought-iron ring is now placed around the model and slightly pressed into the sand, and melted lead is poured over the zinc model and the ring filled up. The removal of the lead counter from the ring will be more easily effected if

the latter is rubbed on the inside with a little dry whitening, previous to pouring the melted metal into it.

After the dies and counter dies are prepared, a piece of thick lead foil is moulded to one of the former, and a pattern cut out to represent the size and shape of the gold plate required. The object of moulding and cutting out the pattern on the zinc die is to avoid any chance of rubbing the plaster model.

Cutting out a correct lead pattern is not by any means such a simple operation as many would imagine, more especially where there are several narrow spaces between the teeth. To mould the lead foil into these spaces, and yet preserve it intact is a stumbling block to the student for some time.

The best method we have found for overcoming this difficulty is to press the foil into the palate, then before the foil is pressed right home the surplus should be cut away. The pattern cannot be cut out too accurately ; the author's opinion is that the more perfect the pattern is the more simple the swaging operation. The only situations where a little surplus may be tolerated and perhaps be advantageous, is the tongue of metal that goes between two teeth, and at the back of the lower front teeth in the case of a bar lower.

If a pattern is cut large, the workman or pupil is very apt to depend upon such excess, to counterbalance any defect of manipulation, and does not therefore take the same amount of care in swaging the case, as he would with an exact pattern.

The lead foil should be moulded accurately and neatly around and between the teeth if any are standing on the zinc model, and care should be taken to keep it free from splits or cracks. This can be satisfactorily accomplished by means of

a blunt-pointed instrument. If there are several spaces into which the lead foil has to be moulded, less risk is run of splitting it, if it is pressed into these, before working it into the palate. The pattern should come up the crowns of those teeth that are not to be clasped, but only one third the way up those that are to be so treated.

The lead pattern should be flattened very carefully, manipulating a little at a time until the whole is quite flat, when it may be gently pressed on the bench or some flat surface. During the flattening process the spreading of the pattern must not be controlled, for as the wrinkles are pressed out it naturally alters its shape considerably.

The pattern is now ready to be placed on a sheet of gold which ought to have been previously annealed, (that is softened by being made red hot), to enable it to be cut without splitting.

Now some amount of care is requisite in cutting out the plate to avoid wasting the gold, by judiciously placing the pattern on it in such a manner that the remaining portion of gold will come in for other suitable cases. Anyone experienced in this particular, will cut four or five plates from a sheet of gold, from which an amateur would only obtain three or four.

After the pattern has been outlined on the gold plate with a lead pencil, a pair of half-round shears is used to cut out the plate.

The recesses in the plate, corresponding to the position of the natural teeth on the model, may be cut out with the same shears ; but as there is considerable risk, especially with a novice, of the shears slipping and making a more extended cut than was intended, it is much the best plan to use plate

cutters, these make a half-round cut through the plate at the deepest part of the recess, and so enable one by making two simple lateral cuts with the shears to remove the piece.

The next operation is to file the edges of the plate smooth, removing all flaws, using for the purpose a smooth rat-tail file for the recesses, and the back of a half-round file for the other parts. If these precautions are not taken cracks may appear in the plate during the swaging process that might otherwise be avoided.

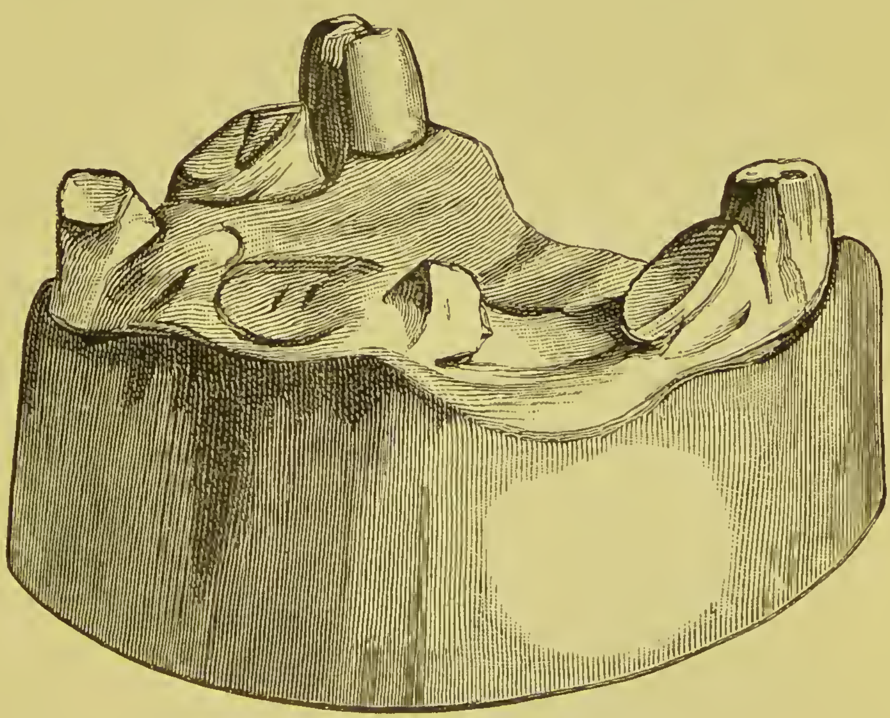

Fig. 10.

After once more annealing the plate, it is ready for the operation known as swaging, or stamping it into shape.

Treatment of the first zinc model.

If there is any difference in the excellence of the two or three zinc dies taken, the worst of the three should be used

first, and any imperfections that may present themselves should be removed with file or sculptor.

When there are natural teeth standing on the model, and the plate has to extend into the spaces between them, these teeth should be reduced one half ; this may be done either with a strong pair of nippers, a metal saw, or a rasp, and the remainder bevelled in such a manner down to the gum to present as wide a space as possible for the plate to be forced into (see fig. 10.)

This bevelling of the teeth on each side of a space only applies to the first zinc cast ; the teeth on the second or best cast may be cut down if the plate is not required to extend up them but the teeth must not be bevelled.

Fig. 11.

This will in a great measure avoid the buckling, or in other words a doubling of the plate.

Having been annealed, the plate may now be partially swaged, or beaten somewhat into shape on the zinc model by means of a bone or wooden mallet.

A few remarks on these tools may not be out of place.

The bone, or rather horn, mallet is shown in Fig 11. The wooden mallet is usually made of box, holly, or other

hard wood. The head is about one and a half inches in diameter and about four inches long, and the ends are tapered to a wedge shape. A hole is drilled through the centre of the head and a handle fitted to it. In the diagram the artist has made the handle of the horn mallet rather too slight.

The young beginner should be instructed to use the mallet as sparingly as possible, as this tool is only meant to get the plate roughly into position, not to make it fit the model, as might perhaps be imagined, from the generous manner in which it is sometimes used. The effect of this treatment is to bruise and destroy its surface, so rendering it more difficult to give the final finish to the case.

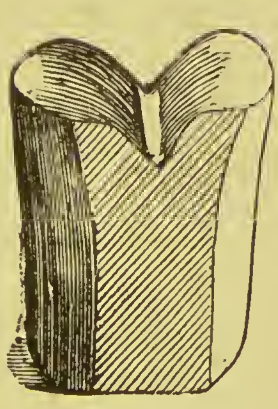

Fig. 12.

The plate from this stage should be placed in Hydrochloric acid to clean it from all impurities prior to annealing.

Where we have a plain upper or lower to deal with, we can approximate the plate somewhat to the alveolar border, by first swaging it into a triangular groove, cut into a piece of wood, (see fig. 12). This gets it somewhat into shape without hardening, or bruising the gold, as would be the

result if beaten entirely into shape on the metal model. The plate is now ready to place in the lead or counter-die ; this should not be deeper than is necessary as it makes the swaging process more difficult.

The natural tendency of a plate is to slide backwards in the counter ; to counteract this it should be placed somewhat more forward than is required. This slipping backward in obstinate cases may be controlled in another way, by cutting a nick in the lead, at the point corresponding to the part where the posterior edge has to extend. If the posterior edge of the plate is fixed in this nick, it effectually prevents any backward movement. This latter plan should not be resorted to unless the plate cannot be controlled by the means previously described. The plate having been placed in position, the counter-die is laid on an anvil or on an iron weight, so formed, that it rests upon the leg. The zinc model is then placed in position,and given a few gentle blows with a hammer or other suitable weight. The plate should then be removed from the counter to see if it is going into its proper position.

Should the result of the examination be satisfactory, it should be placed in H.Cl. for a few minutes and then annealed, after which it is returned to the counter to receive half a dozen heavy blows with the hammer or weight. It is as well to interpose a sheet of thick paper between the plate and the surface of the lead counter; it permits of its more easy withdrawal. It should now be carefully examined and any buckles or doubling of the plate or hollow spaces, between the plate and model,must be punched out with a broad-ended punch or if the plate is split, it should be soldered up to prevent its extending further. We must, however, note, that every time

the gold plate is stamped between the metal dies, it must be cleaned in H.Cl. before any soldering or annealing takes

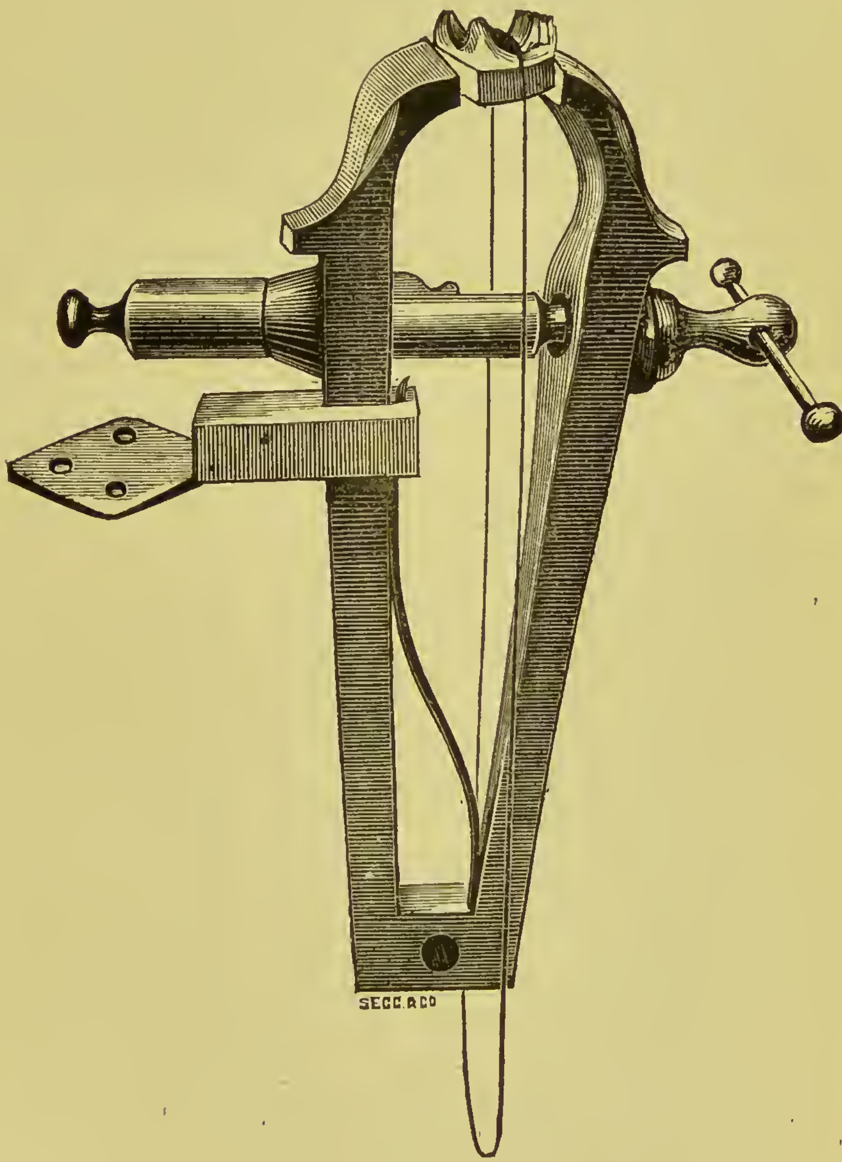

Fig. 13.

place, as the presence of lead or zinc on the heated gold would be seriously detrimental to it.

A few more heavy blows may now be given to the plate which should have the effect of driving it well home on the model. Of course, perfection in swaging is only to be obtained by constant practice. The zinc model with the plate in position, is now fixed in the vice and the plate held in its place by means of the stirrup. (Fig. 13.) It will be seen that one end of the band or stirrup passes across the model; to make traction on it, the foot is inserted in the other end seen below the vice.

We must now take punches (see Sec. 2 Dental Laboratory) and carefully chase round the necks of the teeth and between the rugæ on the palate or into any depression where it has not been driven by the dies. The chasing should be done with suitable punches, some sharp and tapering, others round-ended, in fact the ends should correspond to the situation where the plate has to be forced into, and should be done very neatly so as to avoid the necessity of running solder into the marks, more especially those in the palate where the presence of solder would detract from the richness of the gold and the beauty of the work ; but round the necks of the teeth it rather adds to the finish and strengthens the case.

After chasing, the plate should be trimmed to the right size with nippers and filed into shape, the edges made smooth, and, in an upper case, the posterior edge of the plate should be bevelled to the surface of the palate. Some dentists instead of chasing the plate around the necks of the teeth, use a tin counter-die to finish up the swaging process; this to my mind does not do its work as well as the punch. After the usual "pickling" (the term given to the process of cleaning the plate in H.Cl.), and annealing, it is ready for the last

stamping which should be done on the best zinc cast, interposing between the plate and counter-die, as before, two or three thicknesses of paper. After stamping, the plate should be thoroughly cleaned.

We may now look at our plaster model, and try the plate on it, having first of all ascertained that it fits the best zinc cast, and presents no sharp edges to abraid or rub the more delicate plaster original. This is a point to be observed. The plaster model should be regarded as something that must be treated with the greatest care; it should not bear, even after the work is finished, the evidence of its having been worked to, but should be as perfect when the work is completed as when it was commenced. We may then rest assured, if our model is correct, that the plate will, when placed in the mouth, be a perfect fit.

On the other hand if the plaster teeth are rubbed, the plate when tried in, will rock and spring about in every direction, and never feel comfortable.

In swaging up gold, or in fact any plate, the most prominent parts of the zinc model suffer the most, this flattening or rubbing of the elevations on the zinc model will in all probability cause the plate to rock on the corresponding parts of the plaster model, by reason of the concavities in it not being deep enough. By gentle pressure on the plate we are enabled to localise the place or places where it rests,and to put a pad consisting of one or two thicknesses of brown paper or lead foil on such elevations on the zinc model,and putting the plate in position on the model to give it two or three heavy blows in the counter-die.

The pad of paper or lead is to deepen the concavities in

the plate, by restoring, as it were, the portion that has been rubbed off the zinc cast.

There is another way of arriving at the same result, and that is by placing the plate in the counter and deepening the depressions and rugæ by means of suitable punches, or the more effective way by padding the model to start with.

The second method is very well adapted for deepening and bringing the rugæ into greater prominence.

After the punch has been used the plate should be cleaned and annealed, and then receive three or four heavy blows in the counter-die interposing as before between the plate and lead, one or two thicknesses of paper.

It may now be tried on the plaster model again, and the fit should be demonstrated by its going into its place without the slightest pressure, by its steadiness and freedom from rocking or tilting, also by its perfect adaptation to all parts of the gum and alveolar ridge.

Practically we have now finished with the zinc model, which should be put on one side and not referred to again. The plate fits the plaster model, and should maintain that fit until it is ready for the mouth.

After the plate has been cleaned, it should be cut away for the clasps, filing it down to the gum, but not away from the necks of the teeth where they are very long ; but where they are of medium length it should be filed away to just admit of the thickness of gold composing the clasps, between the neck of tooth and edge of plate. In the former case the clasps will rest on the plate, and in the latter on the gum.

This trimming of the plate requires considerable care, so as not to file away too much, it should be bevelled to the necks of the tooth, or teeth and not filed straight down, the corres-

ponding edge of the clasp being bevelled to conform to it; by this means we are not so likely to cut away more than we want.

When there is a large space between the plate and the clasps, it is much more troublesome to solder, and the resulting joint is not neat.

On no account, must shears be used for cutting, or trimming the plate after the last swaging. All surplus material must be removed either by the nippers or file to avoid bending the plate.

In the selection of teeth to be used for clasping, we must take into consideration their position, shape, and soundness. We must not adjust clasps to loose teeth, because however much the clasps may be tightened, they would not ensure the stability of the case.

We should not only select our teeth as to strength and position, but must only use certain parts of them, in order, not only to admit of the ready insertion and withdrawal of the case from the mouth, but also to ensure the longevity of the tooth or teeth that we fix upon for retaining the work in position.

It has been advocated by some writers that when the plate has been trimmed up for the clasps, it should be placed in the mouth, and another impression taken with the plate in position, and a cast made therefrom in order to adjust the clasps. This we think in the majority of cases is quite unnecessary, for if the first plaster cast is good enough to work the plate to, it should of a necessity be perfect enough to fit the clasps.

To prove this, let us take the following illustration. Suppose a good impression in A 1, or Stent's composition, has

been taken of a mouth in which there are several teeth standing, and these teeth somewhat long and straggling, and a vulcanite case has been made to the model cast from such impression, it will be noticed after the case is finished up, that it will not go into its place in the mouth. Why is this ? Simply because it fits too well, or in other words that the vulcanite has copied, and filled up, most accurately the spaces between the teeth, which spaces as one is well aware, are wider at the gum margin than at the points of the teeth, the consequence is, that until a portion is cut away, the case will not go into its place.

This illustration brings me to the point I am aiming at, viz., how much, and what part of a tooth, should be used for clasping.

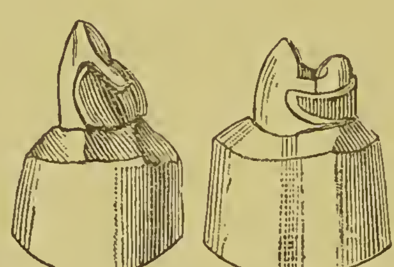

Fig. 14.

The neck of a tooth unless that tooth is very short and cone shaped, is not the proper place for a clasp, for the presence of a wire around it means sooner or later its destruction. We should where possible endeavour to support our work by lateral pressure, and such pressure should be exerted as far away as possible from the margin of gum or necks of teeth.

The lateral bands should form little wings (see Fig. 14), and should be applied against the bulbous portion of the

tooth, very little pressure being necessary if the plate fits properly.

Broad bands should be used in preference to wires for the bicuspids and molars, or if wire is used it should be free from the neck of tooth and bent up at right angles at the end so as to apply the pressure where required.

It will thus be perceived that one good model is all that is necessary for if we were to make our clasps fit the approximal sides of the teeth, we could not get the plate, without great difficulty, into the mouth, nor remove it again, without exerting such an amount of force as would be seriously detrimental to the natural teeth present, for no obstacle should be presented to the patient to interfere with its ready withdrawal for the purposes of cleanliness.

Stout tin or lead foil may be used for making the pattern for the clasps. The student should always be instructed to cut out patterns for his clasps, it educates his eye, both as regards the shape of the tooth, and also the contour of the gum. For the more expert workman this is not necessary, he simply requires to ascertain the length and the greatest width of the clasps. When the clasps are fitted they should be fastened in position by means of hard wax, just warming the plate and melting a little hard wax on it. The pattern for the clasps should be cut out lengthways of the gold, that is, the way it has been rolled, and it should be frequently annealed during the bending up. When fastening the clasps to the plate, they should fit into their places without the slightest pressure. The plate with the clasps attached, is carefully removed from the model, and a little thick borax is painted in the interstices on the under surface of the plate, between the clasp and plate, if any exist. The object of this is to fill up the spaces,

keep the investment out and allow of the ready flow of the solder through, to make a perfect joint.

The case should now be sunk in brickdust and plaster, sand and plaster or pumice and plaster, mixed into a thick batter with water ; each of these investments will answer the purpose. We give the preference to the former, as being a material easily and cheaply obtained, and at the same time not likely to discolour the teeth. The investment is mixed at the time of using in the proportion of two-thirds brick-dust. The object of mixing any of these ingredients with plaster is to render it more porous or open in texture and

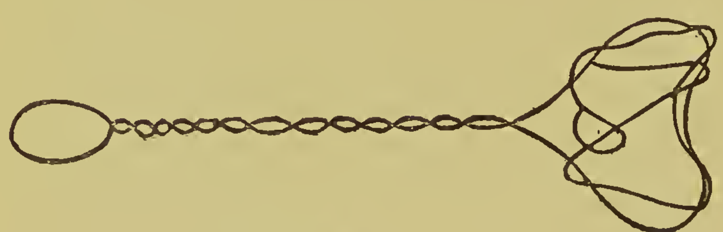

Fig. 15.

lessen its liability to splitting or warpage when heat is applied to it.

In order to still further lessen the liability of warpage, it is usual to embed a coil of iron wire in the investment, at the same time as the plate is sunk into it. This wire may also take the form of a small gridiron (Fig. 15), which can be made of a couple of strands of fairly thick iron wire twisted for about eight or ten inches to form a handle ; the two free ends can then be spread out and coiled into a suitable shape, to securely hold the investment. The handle thus formed also serves to hold the case by, while it is being soldered.

The investment is meant to support the clasps in the position they are to occupy on the plate, and it should be kept away from those places where the solder is required to flow.

When investing a case, care should be taken that there are no overhanging edges of plaster, as these would prevent the flame from acting directly on the spot to be soldered, and a risk would be run of sweating another portion of the plate.

It is as well to trim the investment down to the edge of the bands.

When the investment is set it should be placed on a piece of sheet iron, suspended over a Bunsen burner in order to warm it and soften the wax ; this should not be allowed to melt, but only to soften, when it may be removed *en masse*, or if not, boiling water may be poured over it to clear the remainder away.

The next operation is to prepare the invested plate for the soldering process.

Soldering on the Clasps.

Having cleared away the wax from the plate, borax should be painted on the joints, with a camel-hair pencil, or a thin slip of wood, such as a match made thin at the end. Now, as this is intended to encourage the solder to flow, and make a neat joint, care should be taken not to let it spread over any other part.

Small pieces of solder are next to be touched with borax, and then placed in position along the line of junction of the plate and clasps.

The case should now be placed directly over the flame of a Bunsen burner, and heated until the investment becomes

nearly red hot; this treatment makes the case much easier to solder.

When using the blow-pipe it is always safer at first to have a large soft flame than a pointed one, heating the case throughout to nearly the melting point of the solder and then using a more pointed flame to flush around the joint.

When the soldering is completed, the case should be allowed to cool gradually, and then the investment is removed; by exercising this care one perhaps lessens the risk of any warpage or alteration in the fit of the plate.

The plate should now be placed in HCl if gold, or boiled out in H_2SO_4 if platinum or dental alloy.

The clasps should now be smoothed on the inner edge, next the gum, with a fine file, so as not to scratch the teeth; next fitted and filed to their proper size and shape, and finished, so that the artificial teeth may fit neatly against them.

Clasps against the teeth in the front of the mouth should be bevelled to a feather edge; this not only renders them less conspicuous, but also allows the artificial tooth to fit close, and still further hides them from view.

When any soldering has to be done to the plate without investment, care should be taken to let the plate rest solidly on the coke or charcoal block used.

When soldering a case with clasps on, and where there is a chance of displacing any of them the precaution may be observed of coating the clasps and adjacent solder with whitening.

Another method of affording support to a clasp, etc., is to place a little ordinary casting sand or ground pumice on the coke or block, and so embed the case in it that it affords a support both for clasps and plate.

Each clasp should now be filed separately and adjusted to the model. Whitening painted on should always be used to protect a place where the solder is not required to flow.

It is particularly required to fill in between the edge of the back of a flat tooth and a clasp to prevent one being soldered to the other, and so destroy its usefulness.

If bands are correctly made, a case goes nearly home before it is tightened, and it can be readily taken out and replaced again; wires, on the other hand, are often sprung over the points of the teeth, and the patient not being able to remove the case, the wires have caused decay, and sunk into the softened tooth, thus effectually preventing its removal, except by a dentist. Numerous instances have occurred where the author has had to remove such dentures, and the condition of the mouth has been bad in the extreme.

This brings us to a very important matter, and that is the objection that is generally expressed, at any rate by patients in this country, at the presence of a gold clasp.

It is a strange anomaly that, no matter how many teeth are filled with gold, no particular objection is expressed, but the presence of a portion of a gold clasp immediately calls forth expressions of regret and a desire to have it taken away.

The slant of a tooth is often a serious obstacle to the effectiveness of a clasp, because the more it is tightened on the tooth the more it keeps the case from going into its place. Clasps should be made to act in conjunction with each other and also by themselves. As an illustration, take a molar clasp which encircles the case, tightening the same would constitute an independent hold ; the same may be said of a clasp around the second bicuspid, when the presence of

gold on the buccal aspect of that tooth is not objected to. But where one has the six front natural teeth only in position, the clasps on each canine must act in conjunction with each other, and should encircle as mnch as possible of each tooth without unduly shewing in the front of mouth. If these clasps are made too short then the case is pushed out of its place instead of holding it when the clasps are tightened.

To illustrate this still further let us liken the canine teeth to two poles placed perpendicularly in the ground and up which we intend to climb by means of our hands alone. Now if we stretch our arms out, and can get a grip with our fingers, roughly speaking of two-thirds of their calibre, we can manage to get up them ; but, on the contrary, if our fingers only encircle the bare half of the poles, then we cannot get a grip, but slide away.

This then constitutes the difficulty with a case when we have to depend upon the two canines for support, because, although it is necessary for these clasps to come a little forward on the disto-labial aspect, yet they must be so nicely adjusted and bevelled off, and the artificial teeth fitted up against and encircling them, so to speak, that the smallest possible amount of gold may only be visible, or the patient will object.

We shall in this chapter on gold work explain the method adopted for fitting tube teeth so as to conceal these clasps as much as possible.

The foregoing remarks are in reference to cases where there are no natural teeth posterior to the canines, in other cases, of course, the canine clasps may be shortened so that they only press against the distal aspects of the teeth.

For the construction of clasps the gold should be what is

known as "hard," or "springy," made by alloying it with extra copper or a slight percentage of platinum. 16-carat is the quality generally used ; the gold should be No. 7 or 8 guage, according to the size and length of the clasp. They should be tapered and thinned or bevelled to their free edges, and should be strongest and thickest where they are attached to the plate. Too much care cannot be taken in fitting clasps, for on them will depend in a great measure the comfort of the case and its stability.

It is not advisable to have a greater number than is necessary.

The most difficult cases to adjust clasps to are those where we have the loss of the two centrals in the upper, the remaining teeth being in position and also very short.

In such cases it may be found necessary to use fine wire clasps, acting one with the other on each lateral. This may be supplemented by wings or blades fitted between the first and second bicuspids.

Effect of Clasps on the Teeth.

There is not the slightest doubt but that clasps are destructive to the teeth they encircle, although it is a question whether that destructive influence could not be reduced very considerably, if not altogether avoided, were the patient to exercise a greater amount of care, in scrupulously cleaning the inside of the clasps.

To do this effectually the clasps should in the first place, be highly polished on their inner surface, and when the case is removed at night, as it always should be, if placed in a tumbler of water, along with a small piece of ordinary common washing soda, the tenacious deposit usually adherent to them

is dissolved and it can then be readily removed and the case rendered perfectly clean by a liberal use of soap on the tooth brush in the morning.

It is the keeping of fermented portions of food etc., mixed with the oral secretions, in absolute contact with the teeth for any length of time, that acts so disastrously to them.

The bicuspid teeth, more especially in the lower, are very prone to be affected, and it becomes a serious question as to whether we should not adopt the excellent suggestion of Mr. John A. Biggs of Glasgow, and make a jacket or crown for these teeth at the same time as we are making the case in order to save them from this serious liability.

His usual method is to reduce the tooth to be clasped, to a cylindrical shape, and with a copper tape find its dimensions. 22 carat gold is then cut to the pattern thus procured, which is bent, fitted and fastened with Dirigo Cement. He has many of them in use and says that they answer the purpose admirably.

After setting up the models to the bite by means of one form or other of the articulators alluded to on pages 77 to 84 of the "Dental Laboratory," we are enabled to see the amount of space that has to be fitted with teeth.

These spaces may be of three kinds, the first, deep enough for tube teeth, that is to say where they can be left sufficiently long to be strong, the second, necessitating flat teeth; in this case the opposing teeth bite nearly, or quite on to the gum or plate. The third variety of space may be called intermediate, that is not deep enough for a tube tooth, but still deep enough for a masticating surface of metal or vulcanite, attached to a flat tooth.

When a patient puts himself under our care, in order to

obtain a suitable masticating apparatus, we should endeavour to fulfil our obligation to the best of our ability, for it is of primary consideration for the patient's health that he should be able to thoroughly masticate his food.

By a reference to the teeth in a normal jaw, we find that each individual tooth comes into intimate contact with its fellow, and we should make our artificial teeth to conform to the natural as near as possible in this respect. One cannot

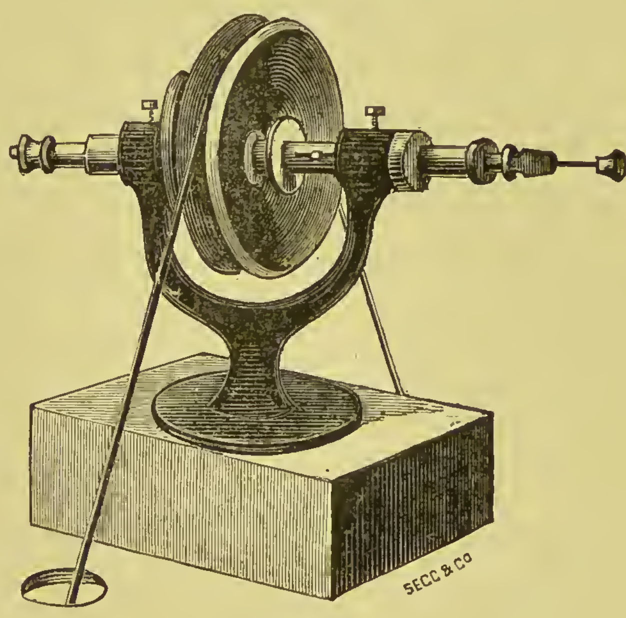

Fig. 16.

have a better biting surface than that produced by the use of tube teeth, and one cannot imagine a purer, more workmanlike, and artistic denture, than a well made gold plate mounted with a set of Ash's tube teeth. There is something about it that speaks for itself, and it will still retain after long years of use, the evidence of the good work put into it.

Appliances for fitting tube teeth.

The Lathe (Fig. 16). The great essential for this, is that

it shall run perfectly true, and be fitted with chucks that will carry the largest, as well as the smallest wheels and cones.

Corundum Wheels range in size from three inches to a quarter of an inch, and also vary both in thickness and in grit. The largest and coarsest are used for roughing down a tooth and the finer and smaller, for fine fitting.

The Chipper. This is for reducing the length of a tooth before proceeding to rough-fit it at the lathe. It is safest to run a groove corresponding to the amount to be cut off, in the base of the tooth with a thin corundum wheel ; this prevents any chance of cracking the tooth.

Carborundum Wheels. These have the advantage over corundum wheels, that they do not wear away so fast, and that they cut more rapidly. They can be fastened on to a chuck with shellac by first melting it on to the wheel, which should be made hot, and then heating the chuck and pressing it into the hole in the wheel.

The Chamfering tool. (Fig.17). This hard steel instrument

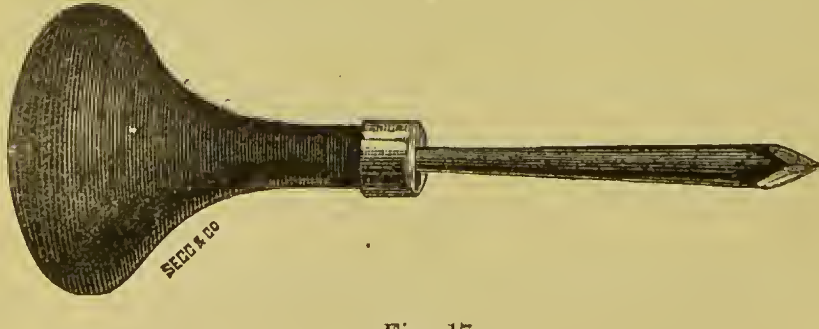

Fig. 17.

is to hollow out the base of a tooth to accommodate an eminence on the plates, or on the solder at the base of a pin. The point of this tool should not be made of too long a bevel, or else it would go too far into the tube, and perhaps burst it when the

force was applied. Other requirements for this work are, some paint, made either of carmine, or vermilion and oil, a tube file, a broach, and a clean linen rag.

All these things should be kept on the lathe bench ready for use.

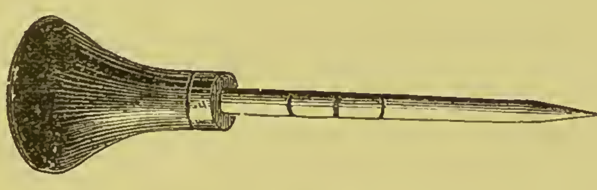

Fig. 18.

For marking the position of the hole in the plate one requires a piece of steel wire that will pass down the tube of the tooth, as a marker; an old broach makes a very good one.

Fig. 19. Fig. 20. Fig. 21.

A stronger pointed instrument to deepen and confirm the hole made by the marker. (Fig. 18). Drill stocks and drill (see Figs. 19, 20, 21). Fig. 19 is drawn large in order to illustrate how it is made. Fig. 21 is a universal stock

that will accommodate a drill made from a broach, etc. The drill bow for use with the drill stock ends the list of tools for this work.

Fitting Tube Teeth.

After reducing the tooth somewhat with the Chipper, we next proceed to roughly fit it to the plate by means of a large corundum or carborundum wheel, so that it rests fairly steady in its place. We will imagine that the case is an edentulous one. Having passed a broach or tube file through the tube in the tooth to clear it out, a little hard wax is next melted on to the back of the tooth. A film of hard wax is also melted around the ridge on the plate.

The tooth is now warmed over a Bunsen or spirit lamp and adjusted to the plate, and then firmly fixed by adding more hard wax on to its back.

We proceed now to fit the next tooth, and having fixed that on in the same manner as the first one, the whole of the teeth may then be fitted and fixed to the plate. They should be kept sufficiently long to allow for fine fitting and adjustment to the bite.

The next operation is to mark the holes in the plate ; to do this we must take an old broach that will pass readily into the tube, and sharpen the end, by making three little facets on it until it is reduced to a point, the same as the chamfering tool previously described. This is passed down the tube and rotated using a little pressure. It will make a mark on the plate, provided the tube is free from wax ; should any have entered the tube, the broach must be slightly warmed and then pressed well home.

Another method of marking is to file an ordinary match quite round, until it will pass down the tube, this is touched

at the end with red paint. This latter, however, is apt to get obliterated when removing the teeth.

Having marked the holes as first described, and seen that the teeth are not disarranged, the next thing is to warm the plate slightly, and remove the teeth ; the plate can now be warmed, and the wax cleaned off, when on examining the plate we shall see the marks made by the broach.

We now take a stronger instrument called a marker, (Fig. 18), and with it confirm and deepen the marks previously made, and the plate is then ready to have the holes drilled (not punched) in it. When drilling holes for the pins, we must take care to make them slant in the right direction. It is much easier to bend a pin outwards than inwards, therefore as a rule the pin should have a bias in the latter direction. The hole should be drilled slightly smaller than is required, and the proper direction should be given it still more by means of a broach ; this should be marked so that it does not go too far through the plate, and make too large a hole. The bur caused by the drill and broach is now removed either by a file or sculptor.

We next take a piece of gold wire that fits the tubes in the teeth, and having passed it through to the point of the tooth, it is cut off with a pair of nippers to the right length. We now take a pair of roughening pliers, and grasping the wire about two-thirds of its length, we proceed to file the end of the wire five-sided ; this is not to taper it, or to reduce its thickness. We now examine the under surface of the plate, and according to the slant of the same, so do we file the end of the wire, that when it is pressed into the hole it will not cause any projection on the under surface. By filing the wire five-sided it holds firmly in its place and enables one to

solder it without other support. The author has seen pins held in position with binding wire in order to solder them, but if the operation just described has been done neatly there is no occasion for any such aid, and the whole of the fourteen pins may be stuck in and soldered at once.

Before the pins are fixed in, the plate should be "pickled," then, after the pins are in position a little borax should be painted around each, both on the upper and under surfaces, and a small piece of solder should be used. The plate should now be placed so that it will rest steady on the soldering block and it should be heated up gradually, so as not to displace the pieces of solder. Where possible it is safest to direct the flame under the plate, and not directly on to the pins; one runs much less risk of sweating (melting) them. I would here mention that a clean hard piece of ordinary coke makes a very good block to solder on.

After the pins are soldered, and the under surface of the same made flush with the plate, the teeth should be adjusted, and if found to be in the right position, the pins should be cut down to the bite. We may now proceed to fit the teeth.

First of all we must clean the teeth of any adherent wax, then having made a thick paint of vermilion and oil we paint around the base of the pin, corresponding to the circumference of the neck of the teeth.

Now if we place the tube tooth on the pin until it comes in contact with the plate we shall find on withdrawing it, that it has a spot of paint on it—this must be ground out with a suitable wheel, and then the tooth replaced on the pin and the operation repeated. Sometimes we find the tooth resting on the solder around the base of the pin, then we must use the chamfering tool to work a little away from around the base

of the tube ; at other times one has to fit the tooth over a small elevation, in such a case one must use a very small wheel, (Fig. 22), or a carborundum cone such as could be fitted into the small chuck (Fig. 23). When a tooth is considered as fitted, there should not be the slightest space between it and the plate, and one ought to be able to grasp the

Fig. 22.

Fig. 23.

tooth, and when pressing it on the plate, not be able to give it any rotary motion.

Before quite fitting the tooth it is best to adjust it to the bite, grinding it if need be, to conform to the articulating surface of the opposing tooth, after which finish the fine

fitting. If tube teeth are fitted properly, and they are steady on the pin, the sulphur which is used as cement will hold them securely, but if they do not lie steady on the plate then the rotary movement of the jaw will cause them to become loose.

After the teeth are all fitted, the edges should be slightly bevelled inwards with a very fine wheel; this takes away any roughness, and makes a neater finish with the plate. Then they should be washed with hot soap and water, and a piece of string or wool passed through the tube to clean them. The plate should also be washed perfectly clean, all red paint removed, and pickled. After drying the plate the pins should be roughened with a pair of roughing pliers; this is done by grasping the pin, not too firmly, and rotating the pliers, or else the pins may be slightly nicked with a sculptor. The molar pins may also be rounded at the points.

The pins must not be made so rough that the teeth have to be forced on, as it would involve a risk of cracking the tooth.

Before placing the teeth on the pins it is as well to clean the ends of the tubes from any outlying edge of platinum.

The last operation is to cement the teeth on with sulphur. This is best done over a spirit lamp or the small flame of a Bunsen burner. We begin by placing small pieces of sulphur about double the size of a pin's head on the crowns of the molars and bicuspids on one side, then heating the plate until the sulphur melts; when the sulphur begins to run down the tubes, another series of pieces may be placed in position, and the operation repeated until the sulphur appears around the tooth at its junction with the plate.

We next cement the opposite molars and bicuspids, and

lastly the front teeth. They do not require so much heat as the larger side teeth, and we thus run less risk of melting the cement out of the others during the process of heating up.

After cementing on the teeth, the finishing touch may be given by grinding the pins of the front teeth and bicuspids flush with the tooth, and then rubbing them with water of Ayr stone.

Fitting Single Tube Teeth.

The previously described method of adjusting the teeth, and marking the holes for the pins, applies where there are several teeth in a row to be fitted, but where a tube tooth has to be fitted against a natural tooth, it may be held in position by the thumb and finger while the hole is being marked with a broach. After deepening the mark with a suitable pointed instrument, the broach may be passed into the tube, and the point of it made to rest in the mark, thus the broach will represent the pin, and give one a very good idea as to whether the mark is correct or not. Should it not be right it can at this stage be easily altered.

When clearing out the tube of a tooth with a broach, care must be taken not to press the latter too far; it should fit loosely, and be pressed against the sides while being rotated. If it is pressed tightly into the tube it is very apt to crack the tooth; beginners should be particularly warned against this.

It often facilitates the fitting of a tooth, in a space between two natural ones that are clasped, to remove the plate from the model, and fit the tooth to the right length on the model itself; we have then, when the plate is replaced on the model, practically only the sides of the tooth to look after, an

amount of tooth substance (corresponding to the thickness of the plate used) being only required to be ground away from the lingual aspect of the base of the tooth, to allow the part to fit on to the gum as before.

The fine-fitting of the sides of a tooth to a clasp can only be acquired by diligent practice. It is a very good plan for a beginner either to file up and fit a few bone teeth to such spaces, or plaster teeth may be cast in a mould, taking as the pattern the tube tooth ultimately to be used. After a short time the student recognises the convexities of the clasps and teeth, and soon begins to understand how to grind the tooth to fit them.

When fitting a tube tooth against a clasp, it is as well to reduce it nearly to the proper length before grinding any off the side, then in placing it in position to mark the pin, the tooth should be brought close up to the clasp at its neck ; as an example, suppose we say the clasp is against a canine tooth, the crown of the artificial bicuspid should slant slightly backwards. Now when the pin is soldered in, and we bend it slightly to the canine, we shall find that the tooth will not go into its place. If we paint the clasp and try it once more, a mark will be found where it rests, this must be carefully ground away, care being observed at the same time not to interfere with the neck of the tooth. A further bending of the pin towards the canine can then be made, and the tooth fitted, until it is in its proper upright position, when it will be found after fine-fitting to lie snugly against the clasp, without any division whatever.

Fitting Flat or Half Teeth.

When flat teeth are to be used, it is as well to nearly fit them, before backing, that is fastening to the backs of the

teeth, by means of the pins, a piece of plate corresponding to the shape of the back of the tooth, as a means by which it can be soldered to the base plate.

Until the student gains experience in fitting these teeth he may use a little red paint on his model, but the skilled workman rarely has recourse to this aid. The small size of the base or neck of the tooth, enables him to see where it is resting so that it can be accurately fitted, and when the back is adjusted to the tooth, he can then finish the remainder of the fitting with the bite in position; this affords great assistance in regulating the exact position of the tooth as regards projection etc.

Great care should be observed in fitting these teeth that a sufficient amount of tooth substance is left around the pins for strength, and if it is necessary to fit a tooth very short it should be reduced at the point as well as the base, in order to bring about this result. Where a tooth has to be reduced in width to fit into a narrow space, one should be selected with the pins sufficiently close together, or better still with the pins one above the other.

The method of backing a tooth is to take a strip of gold, (No. 8 guage) of the same width as the length of the tooth, this is held on the bench-pin with the left hand, while the tooth to be backed is held in the right. The pins of the teeth are now rubbed on one end of the gold strip, this will make two parallel lines, if another line is drawn across these two, corresponding to the distance of the pins from the neck of the tooth, it will give us the exact spot where the holes have to be punched or drilled. When the holes are made, the pins should slip easily through them, until the plate rests against the back of the tooth. A line can now be marked with a

sharp pointed broach around the margin of the tooth on the plate, and then the tooth is to be removed and the plate cut and filed to the required shape. If the pins fit tightly into the holes in the metal back, the tooth is very liable to be cracked in soldering.

The holes should also be enlarged a little externally with a chamfering tool, so as to admit of a head being made on the pins by rivetting ; it at the same time permits the solder to flush better around the head of the pins. If the teeth are to be rivetted, it may be done safely in the following manner.

After trimming up the back to the proper shape, place it in position on the tooth, then cut off the pins leaving only about the 32nd of an inch projecting through the back metal, see that the back lies perfectly true and steady on the tooth, then paint a spot of borax on the inside of the back to encourage the solder to flow through. We next place the tooth with the back in position upon a piece of hard wax made just sufficiently soft that the front of the tooth can be pressed into it, the wax may rest upon a piece of lead. The wax forms therefore a good support for the whole of the tooth. Now with a rivetting hammer we give the pins a few light blows, so as to form a head to the pins, but not sufficient to draw the back too tightly on to the tooth. Should this be done, we may have, when the teeth are soldered, an expansion taking place in the gold forming the back, and the tooth cracking in consequence.

Another way of fastening the back to the tooth is to place the back in position, then with a fine file reduce the external aspect of the pins until flat ; next bend the pins to the right and left flat against the back. If this is done neatly, it answers admirably, and is strong, but it does not do

so well if the pins are left round. There is also less danger of breaking the teeth.

Flat teeth when fitted, should have their backs in intimate contact with the gold base-plate, in order to ensure neat soldering.

The teeth when fitted should be fastened to the plate with hard wax, the whole is then removed from the model and sunk into an investment of brickdust and plaster.

When hard, the case is warmed up until the wax attaching the teeth to the plate, is softened, it is then removed, and the investment trimmed up ; borax is next painted on the plate and backs of teeth, and sufficient solder used to make a good joint.

The case should now be heated over a Bunsen burner and made nearly red-hot, then soldered, and allowed to cool gradually, by placing it in a fireclay pot or other convenient vessel. When cold the investment may be removed and the case placed in H.Cl. to clean it. After this it is filed up and all scratches removed either with file or sculptor, and a surface obtained by rubbing it with water-of-Ayr stone. This latter prepares it for the operation of polishing, which is done by rubbing the case at the lathe with a stiff circular brush using with it finely ground pumice stone, mixed with either water or oil.

As pumice and oil cuts quicker than pumice and water, care must be observed in polishing so as not to rub the plate all one way, or it may be made thin in places.

To polish concavities in the plate, where the lathe brush cannot be made to penetrate, it will be necessary to use a pointed piece of soft wood, charged with pumice, and afterwards with whitening.

After rubbing with pumice, the case should be washed with soap and water, and then polished with whitening or rouge, using a softer brush ; it is again washed with soap in hot water and dried with a nice soft rag.

How to make a Strengthened Lower Plate.

To make a plate such as is represented by Fig. 24, we must prepare the plaster model for casting, either by drying and varnishing, or by boiling it out in stearine. Next, it has to be padded with wax along the inferior border of the alveolus in the buccal and lingual regions ; this is to turn up the edge of the plate so as to take the pressure off the gums. This padding may extend from the first bicuspid to the end of the plate, and should be about the thickness of a piece of No. 9 plate at the edge, tapering to nothing as it ascends the ridge, that being left clear. The model may now be cast in sand, and three zinc dies and lead counters prepared. Having selected the worst of the dies, the teeth should be bevelled down. A lead pattern is now moulded to the zinc model and trimmed to the proper size. We then flatten the pattern and cut out the gold plate. This should be No. 8, 18 carat. We next proceed to file the edges of the plate quite smooth and free from flaws, after which it should be annealed.

We now with the wooden mallet beat it into the space corresponding to the two front teeth; next we take the wooden block, Fig. 12 and bend the ends of the plate so that they overlap each side of the ridge ; the plate must not be hammered around the bicuspids, until the front part of the plate is confirmed in its place, as it would tend to draw the plate downwards and backwards. When the former is assured the

plate can be rapidly swaged up. It is as well, however, to place paper between the dies during the operations.

After the plate has been swaged into its proper position it should be chased around the necks of the teeth, and trimmed to its proper size, and then after cleaning and annealing it may be stamped on the second zinc model, until a perfect fit is established.

Fig. 24.

We may now try how it fits the plaster model. If we find this satisfactory, the next thing to do is to swage up the strengthener. Fig. 24 represents a plate ready for the strengthener. We now cut out a lead pattern to the size of the strengthener required; this may be of No. 6 or 7 guage. We next proceed to swage the strengthener into position, and the simplest method the author has found for this operation is to take the first zinc die and counter, and after annealing the strengthener, bend it roughly to conform to the counter die; to hold it in position three nicks are cut in the counter with a half-round sculptor, corresponding to the two ends and the

middle of the superior border of the strengthener. When the edges of the plate are clamped into place by bending the lead over, it is held so securely in position that there is little chance of any displacement when the zinc model is placed in the counter and a blow is struck.

Having confirmed it in its proper place, it should be cleaned and trimmed to the size required, (Fig. 25), and again annealed.

Fig. 25.

We now take the best die and counter and place the strengthener in position, giving it a gentle blow or two to establish it in its place ; the gold plate is then placed over the strengthener, and after pressing the zinc model into position, it is given four or five heavy blows.

The plate and strengthener are now carefully removed from the lead counter either by gently lifting up the edge of the plate with a suitable instrument, or by giving the face of the counter die a blow on the swaging block.

The two plates are now placed in the acid to clean, and then tried on the plaster model ; if the fit is satisfactory, the next operation is to prepare for the soldering.

Strengtheners.

The addition of a strengthener to a gold plate is twofold. In the first place it stiffens and strengthens the plate, and permits, in the case of a lower, of the lingual edge of the plate being made thick and round, so that it is not likely to fret or chafe the soft tissues lying beneath the tongue in the floor of the mouth.

In the second place it makes the plate thicker along the top of the ridge, and so gives a stronger and better hold for the pins if tube teeth are used.

Fig. 26.

In partial cases where the plate has to pass between two natural ones, for the purpose of carrying an artificial tooth, it should be doubled; more especially is this necessary when the tooth on each side of the space is clasped, so rendering the narrow tongue of metal weaker.

All strengtheners before being soldered should accurately and closely fit the plate, and except in the case of the lower

edge of a lower plate, should be bevelled to a feather edge where it joins the main plate, and the outer surface of the plate and the inner surface of the strengthener should be made clean and bright, either by scraping with a half round sculptor after pickling, or by giving them a rub at the wheel with pumice.

The opposing surfaces of the plate and strengthener should be painted with a little thin borax, and the two plates held firmly together by strong iron clamps (see fig. 26). If these precautions are not taken, and the plate is made hot in order to solder it, the borax swells up, and is likely to displace the strengthener, and make the soldering very difficult, if not altogether impossible.

When soldering a strengthener, Ash's No. 2 or its equivalent is used, cut into small pieces, and arranged, after dipping in borax, along the superior border of the plate. Then the plate should be heated under the blowpipe until the solder melts and appears at its lower border. Sufficient solder should be run along the margins to obliterate the line of junction, and also to permit of a good finish.

All other soldering may be done with No. 3, which is a slightly lower grade.

Sometimes it is necessary to solder a piece of pivoting-size wire around the border of a gold plate. This allows not only of a thick round edge being made, but also allows of a little easement of the plate should it press anywhere.

There is another form of strengthener used principally when one has to adapt prominent teeth to an upper gold plate. These teeth have a great tendency to be bitten outwards, and to overcome this a piece of thick wire flattened,

adapted and soldered to the front border of the plate, will permit of the teeth being brought a little more forward at their necks, and adds greatly to their strength and appearance.

To Form a Masticating Surface in Shallow Cases.

In some cases where the bite in the bicuspid and molar region is very shallow, we may employ solid metal teeth in the place of those of porcelain. These teeth may be made conveniently in either of the following ways : The first method is to mould up a piece of composition on the plate and articulate it to the bite ; we next file up the composition to the form of the teeth as neatly as possible. The composition, now fitting the plate and bite, is removed and sunk midway in an investment of brickdust and plaster, which, when hard, is trimmed up ; then holes are made in it, to act as guides, and the surface is soaped, and finally more investment is mixed up and poured on the surface to form the other half of the mould. We have now a composition tooth or teeth embedded in brickdust and plaster. The next thing is to place the mould in hot water, this will soften the composition teeth, and allow of the parting of the mould. After which the composition is removed, and a gateway made for pouring in the metal. Besides this main gateway, which should be situated in such a position that the portion of metal in excess can be readily removed from the cast tooth without altering its form, there should also be scratches extending from the centre of the mould to its circumference ; these are for the escape of air, when the metal is being poured.

It is as well to bind the mould together with iron wire, and while the silver or other metal is being melted the mould can be placed in the furnace in such a manner that it can be readily heated up, without endangering it. It should be very hot when the metal is poured into it.

Another method, is first to mould a piece of platinum foil to the plate. The foil should be slightly larger than the base of the tooth required. We now neatly mould up a tooth in waxor composition on the foil,and articulate it with the bite. Removing the foil with the wax tooth and sinking it in brick-dust and plaster up to the level of the top of the wax, the next thing is to warm up the invested wax tooth; then remove the wax leaving the platinum foil in the base of the cavity, and afterwards heat up the mould over a Bunsen burner until nearly red-hot. We now take some scraps of silver and gold and flow them by means of a Fletcher's blowpipe on to the platinum foil until the space left by the wax is filled up. We shall now have a metal tooth that will fit the plate perfectly, and only require the articulating surface to be filed up.

These teeth if of gold need not be of so high a standard as the plate, but if of a lower standard the alloy should be silver in preference to copper.

There is yet another method,and that is to melt up some gold or silver under the blowpipe into a button, which must then be filed into shape and fitted to the plate ; this method is not so workmanlike as the first named, but is more useful when one has to make a biting surface at the back of flat teeth. These, where possible, should have a gold biting surface, made to represent the back of a natural tooth attached to them, either by soldering it to the back prior to fixing to the

plate, or, at the same time that the teeth are being soldered to the case. A shallow biting surface may also be made of vulcanite.

As a gold plate fitted in the way described should command a liberal fee, so should we be liberal and conscientious in our work, and not shirk a little labour to arrive at more perfect results.

Combination of Gold with Vulcanite.

We may have cases presented to us where the second bicuspids and molars have been lost on both sides. In these cases if the spaces are very deep it is advantageous to mount the teeth in vulcanite on the gold. We have in such cases the advantage of the gold plate taking up less room at the backs of the front teeth and also of the vulcanite in building up the lost alveolus, and making a piece in which the food cannot accumulate, as unfortunately happens where long tube teeth are used.

How to Construct an Upper Suction Plate.

These cases should not be undertaken without due precautions. It is not every mouth that is suitable for such a plate, and before venturing on making one, it is safest to swage up a German silver, or gilding metal trial plate, in order to ascertain if the result is likely to be satisfactory.

Having obtained the zinc dies and counter dies, we next proceed to cut out the lead pattern, taking care to bring it well over the alveolar ridge on the buccal and labial aspects of the model, for the amount of suction or stability of the

case depends materially on the plate being brought high up in these regions.

The plate should be of No. 8 guage, and be annealed before being cut out to the pattern.

After cutting out the plate and filing the edges smooth, it should be again annealed, and it may then be beaten somewhat into shape on the wooden block (Fig. 12). After getting the ridge well defined in this way, the plate may be beaten well up in the palate in the zinc model, with the horn mallet,

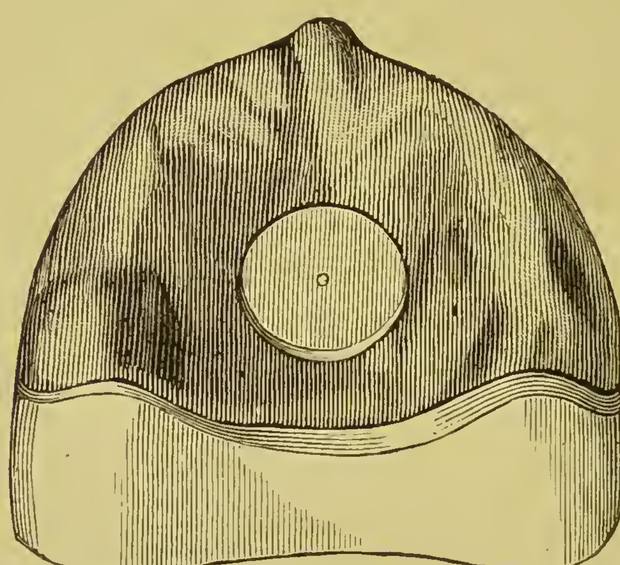

Fig. 27.

and from this time to the finish it should be pickled and annealed after each swaging. A very good way to force the plate home in the palate, is to use a thick boss of lead, conforming to the shape of the palate, and with it drive the plate up in the palate with a hammer. Or a brass punch may be used, interposing between it and the plate a thick

piece of sheet lead ; this is to avoid the risk of bruising the plate.

When the plate has been driven well home in the palate, it may be placed in the counter die, placing between it and the counter one or two thicknesses of paper ; this allows it to part readily from the lead.

We may now give the zinc die about half a dozen heavy blows on the swaging block.

After removing the plate from the counter die, we place it on the zinc die, and on examination may find that it has several buckles, (that is a doubling together of the plate), in front ; these must be beaten out either with the horn mallet or a broad ended punch. To avoid the spreading of the plate, consequent on flattening these buckles, it is usual to make a cut into the plate at one or two points with a fret saw, this will allow the divided edges of the plate to overlap, and thus contract it so as to lie close to the model. If the plate is pierced with the saw neatly, and on the slant, and the edges bevelled, the plate can be soldered up without showing a join.

After this operation, the plate should be placed on the best zinc die, to receive three or four heavy blows in the lead counter, and made to fit the zinc model; when this is assured, we may clean the plate and try it on the plaster model.

Now, although we may find that it fits the zinc model accurately, it is a very tight fit, or binds on the plaster model.

This is accounted for by the fact that there has been some considerable contraction in the zinc die, and it is as well under these circumstances to try the plate in the mouth, when in nine cases out of ten the tightness of the fit will be found

advantageous rather than otherwise, the mucous membrane of the mouth, (not like the hard plaster model), yielding sufficiently to allow the plate to go well home.

If this fact is proved after trying the plate in, then we can pare a little away from where it binds on the plaster model, in order to let it up into its place. If we find, however, that the pressure on the alveolar border is too great, it will be necessary to pad the zinc model with a little brown paper or pattern lead, and after carefully annealing the plate, to place it on the zinc die, taking care not to displace the pads. It must now receive three or four heavy blows in the counter and be tried on the model again.

At this stage of the work, while we are ascertaining the fit of the plate, it is as well to get the correct articulation of the mouth or "bite." To do this it will be necessary to soften some composition, not wax, that being a material much too easily altered in form, then form it into a roll and adapt it neatly to the ridge of the plate. To secure it firmly, dry the composition, if it should be wet, and make the plate sufficiently hot that the material used will melt on it, then cool, and trim up as near as possible.

It will now be necessary to try it in the mouth, when perhaps it will be found that the contact is only in the molar region; so we must trim some of the composition away, in order to get it to touch all round equally. We may now slightly soften the surface of the composition corresponding to the position of front teeth, leaving the molar region hard, then replace in the mouth and get the patient to close the teeth again. We must take notice that the proper length of the face is preserved, also that the lips can close without any strain, we must also build out the composi-

tion to the extent necessary to produce the proper contour of the lips, as this will be the guide as to the length and projection of the teeth and also the centre of the mouth. We may now slightly warm the surface of the composition in the molar region, so as to correctly adapt the opposing surfaces, then we may finally finish off by slightly softening the front portion of the composition to allow the front lower teeth to bite in a little deeper. By these means one is enabled to get the bite stronger at the sides of the mouth than in front, and so add very greatly to the utility of the case.

We may, of course, if found necessary after trimming the composition bite to its proper depth, place a thin layer of soft composition on its surface, and get the patient to close the teeth firmly, by this means we get a correct representation of the points of the opposing teeth, without taking a regular impression of them, as in the first case, the hard composition at the same time preventing the bite from being made any shallower.

As the bite is nearing its perfect stage the adhesion of the plate to the roof of the mouth ought to become more and more apparent, and this operation should conclusively demonstrate the success or otherwise of the future case. We have found in obtaining the "bite" that the patient should, preferably, sit perfectly upright and with the chin slightly depressed, this prevents greatly the protrusion of the lower jaw, which is a very common occurrence, and the student should take notice that the patient cannot bite too far backwards, but can do so forwards with the greatest facility.

Various Methods for Preparing a Suction Chamber.

When the plate has been swaged up so that it fits the plaster model, the shape and size of the intended chamber is marked out on it, and a series of holes drilled within the circumference of this outlined space. Now if we unfasten one end of a fret saw from the frame and pass it through one of these holes, and then adjust it to the frame again, we shall be enabled by using the saw carefully to cut out a circular or other shaped piece from the plate with the greatest facility.

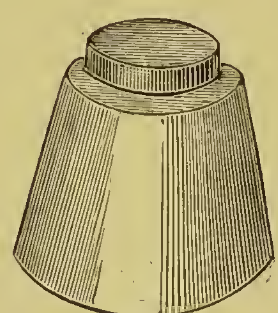

Fig. 28.

After the edges of the plate have been made symmetrical, a lead or rubber pattern of the depth required is fitted inside the space (Fig. 27). A small piece of composition may now be softened and pressed on to the surface of the plate and raised disc, after previously dusting the latter with French chalk. We next attach the composition to the plate by a little hard wax, and then remove the plate from the model. We now take away the disc, and into the cavity left by its withdrawal, plaster of Paris is poured, and built up so as to form a model for a zinc die, (Fig. 28). To this plate a lead

counter is made, and a piece of No. 7 plate, Ash's guage is struck up to it, so as to produce a perfect chamber; this when trimmed up, is fitted within the cavity in the plate, to which it is next attached by hard wax, and afterwards sunk in an investment of brickdust and plaster to be soldered to the plate. The edges of plate and chamber are now brushed with a solution of borax, and very small pieces of No. 2 solder placed close together around the join. The case is then heated up and the solder nicely flushed.

By leaving the edges of the chamber projecting slightly through the plate on its superior palatal or upper aspect, we are enabled to have the edges of the chamber exercise some slight amount of pressure on the palate if found necessary, and produce a more perfect vacuum.

When no pressure is required to be exercised on the palate a suction chamber may be made as follows. Outline shape on gold plate after swaging process is finished, drill holes around as previously described, and cut out the plate to the shape required, then having trimmed the edges, the plate is placed upon the plaster model (Fig. 27) and a piece of lead, or tin, of the proper thickness is fitted into the cavity, and to the model, to which it has next to be cemented by hard wax. A cast is now taken in sand of the model with the plate in position and a zinc die and lead counterdie obtained. These are to swage up a piece of No. 7 plate so as to cover over the disc of metal and rest on the plate, to which it has afterwards to be fastened, invested and soldered as described previously.

Another method, but not so artistic, is to form a suction chamber in the plate as it is being swaged up. To accomplish this it is necessary to adjust to the palate of the plaster model

a tin, lead, or rubber pattern of the same shape as the chamber required.

From the model with the pattern attached, a die and counterdie are obtained, and the plate is swaged as previously described ; it must be carefully chased around the suction chamber, so as to make it as sharp as possible.

The objection to a suction chamber formed in this manner, is that the edges of the chamber cannot be made sufficiently sharp to press against the palate to produce the necessary vacuum.

It is however, necessary in most cases, to take the pressure off the centre of the hard palate, even if we do not contemplate a regular suction chamber. This may be done by placing one or two thickness of pattern lead, or thick tin foil, over the ridge in the centre of the palate extending backwards to within a quarter of an inch of the posterior border of the plate. If this precaution is not taken the plate may, after being worn some time, and having sunk slightly into the soft gum, be found to rock from side to side owing to undue pressure in this region where the gum is thinner and harder.

The shape most suitable for this purpose is a narrow heart or lozenge shaped piece of metal the apex coming well forwards and the base extending to within a quarter of an inch of the posterior border of the plate.

There are other methods of increasing the suction of a gold plate; one is to carefully outline the extent of the plate on the plaster model prior to casting the zinc dies, and carefully scrape the model so that the edge of the plate when swaged must press slightly into the soft mucous membrane.

Another method is to draw some platinum wire as fine as

a thread, and solder it around, and within the circumference of the plate to produce those linear markings mentioned before in relation to vulcanite work. This if neatly done increases materially the suction of a case and adds to its stability.

Mounting Swivels on a Gold Plate.

These should be adjusted to the case after all the pins are soldered on and the tube teeth fitted. Their position is usually between the second bicuspid and molar on each side.

By this arrangement the springs when attached very fairly balances the set, and an upward pressure is exerted, without any tendency to displace the cases from the alveolar ridges,

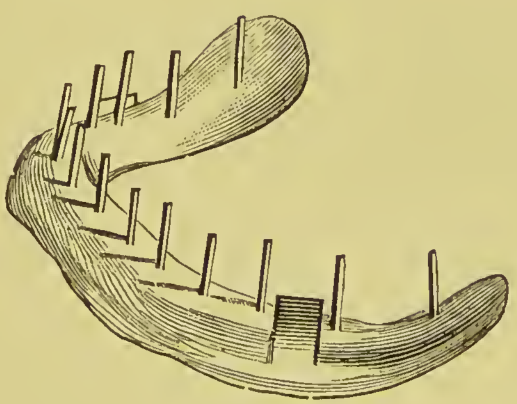

Fig. 29.

or thrust them from the mouth, as the author has seen on many occasions when the swivels have been wrongly placed. The following methods will serve to illustrate how they are attached to the plate.

A piece of No. 9 plate ¼ of an inch wide is taken and bent

at such an angle that one portion of it shall fit the plate whilst the other shall be upright, and have the proper inclination for the swivel to work on (see Fig. 29). This the standard is fixed to the plate by means of a clamp (see Fig. 30,) whilst the teeth are in position, the teeth are then removed and the standard soldered to the plate. A little whitening may be smeared over the pins in the vicinity, as a precaution, to prevent them being melted during the operation. A hole should now be drilled in the standard for the bolt of the swivel to pass through, and be so placed that the spring when screwed on the shank or bolt of the swivel should have the necessary curve.

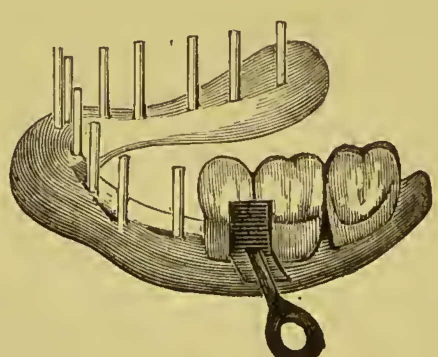

Fig. 30.

Having reduced the swivel bolt to a length suitable for rivetting, and chamfered the hole in the standard on its palatal aspect, it is placed in position and rivetted until it is held firm. Before soldering, some whitening must be introduced between the head of swivel and the standard, also between the eye and bolt of the swivel, in order to prevent the solder from running through and soldering them fast. This should be done thoroughly by working the swivel to and fro until the whitening appears through.

The shank of the swivel should, if possible, rest on the plate, and together with the outside of standards be coated with whitening to prevent them being "sweated" (melted) during soldering. When the swivels are mounted, they should give the springs an inclination parallel to the teeth, and not projecting outwards towards the cheeks.

Another method, and perhaps a more general one is to first make the standard and solder the swivel to it, taking of course the usual precautions. Then the standard with the swivel attached (Fig. 31) is filed up so as to conform to the surface of the plate, and fastened to it with hard wax. A little investment of brickdust and plaster is placed around the shaft of the swivel, and just resting against the standard, but not so as to prevent it being properly soldered. It may now be gradually heated up over a Bunsen, and the standard soldered to the plate.

When fixing swivels to the standard by rivetting, the precaution must be taken that the hole drilled must fit the wire tightly.

Great care must be observed in the arrangement of swivels; in the first place, they must be so adjusted that the springs do not come into contact either with the cheeks or gum. Secondly the springs should have a good bow when the mouth is closed, and thirdly, they should be worn as long as possible.

It is a very good plan to put on a pair of common springs for a week or two, in order to let the patient get experienced in their use, and then put on the gold ones. Patients should be instructed to bend them always in one direction, in order to avoid crippling them.

The advantages of springs in certain cases are manifold, in

the first place they hold up the case firmly, secondly they allow of a much narrower case being worn, and give a feeling of security to the patient in keeping the lower case steady in its place. The objections urged against them are that they entrap the food, tire the jaws, and are apt to break at inconvenient times, and such is often the case. They, however, have their place as dental appliances, and in a considerable number of cases, cannot very well be dispensed with.

As a general thing, these appliances are best obtained from the Dental Depots, but there may be times when one finds it useful to be able to make, at any rate, the swivels oneself, and the student should not consider his education complete, unless he can turn out a creditable set of swivels. One cannot, of course, expect the finish on the home-made article to equal that prepared by a proper machine, but still they can be made in a workmanlike manner, and answer every purpose.


Fig. 31.


Fig. 32.


Fig. 33.


Fig. 34.

For the manufacture of swivels we must provide ourselves with some gold wire, 16 carat, of the same guage as that on which the springs are turned, also some No. 10, 16 carat plate. The following diagrams will serve to illustrate the manufacture.

Fig. 32 represents a half inch length of gold wire.

Fig. 33 represents a piece of No. 10 gold plate $\frac{1}{8}$ of an inch square, with a hole drilled through the centre, to which the wire (Fig. 32) is soldered.

Fig. 34 represents Fig. 33 filed up to form the head of the

swivel, and it is now called the bolt. A small pin vice is the most suitable tool to hold these pieces while filing.

Fig. 35 is a piece of No. 10 gold plate ¼ of an inch square, on to one side of which a piece of wire to represent the shaft of the swivel is soldered, while the plate, after being drilled to admit the bolt (Fig. 34) represents the eye of the swivel. To get this into shape it should first be filed square, then the points taken off and made eight-sided, and finally reducing the angles and converting it into a round such as is represented by Fig. 36.

Fig. 37 Represents the bolt fitted into the eye and the swivel finished up.

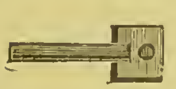
Fig. 35.


Fig. 35 (Side view.)


Fig. 36.


Fig. 37.

The general directions for making a set of swivels may be summed up as follows :

Cut four pieces of wire half an inch long, and slightly flatten one end. Now cut a piece of No. 10 plate a quarter of an inch wide and one inch long. A groove should be made in the soldering block, or a piece of coke, to allow the slip of plate to rest in, now mark on the plate the places where the pieces of wire have to be soldered, and make four corresponding grooves in the soldering block to rest the wires in. All the soldering can be done at one operation. We can now divide the slip of metal into portions corresponding to Fig. 35.

We now take another strip of metal one-eighth of an inch wide, and one inch long, and drill at equal distances four

holes in it. These holes are broached out to the proper size, and four half inch lengths of wire are soldered into them. The plate is now divided into four, and each bolt is filed up separately

How to Construct a Partial Upper Strengthened Gold Plate

Fig. 38.

After the usual zinc and lead casts are obtained, a lead pattern is moulded up and a No. 6 gold plate cut out corresponding to Fig. 38, this is swaged until it fits the model, as represented in Fig. 39. Thus the strengthener may be either in the inferior or superior palatal aspect of the plate, in this case it is in the superior, the only advantage one gains by having it on the superior palatal aspect is that it allows of a better finish to the case. The strengthener is now trimmed to size and the edges bevelled.

We now strike up thè plate as represented by Fig. 40. It should be roughly got into shape, before introducing the strengthener, after which the two should be struck up together, until accurately adapted to the zinc model.

They may now be tried on the plaster model, and if a good fit, the next thing is to brighten the surface of the plate and strengthener. Then paint over the opposing surfaces a thin

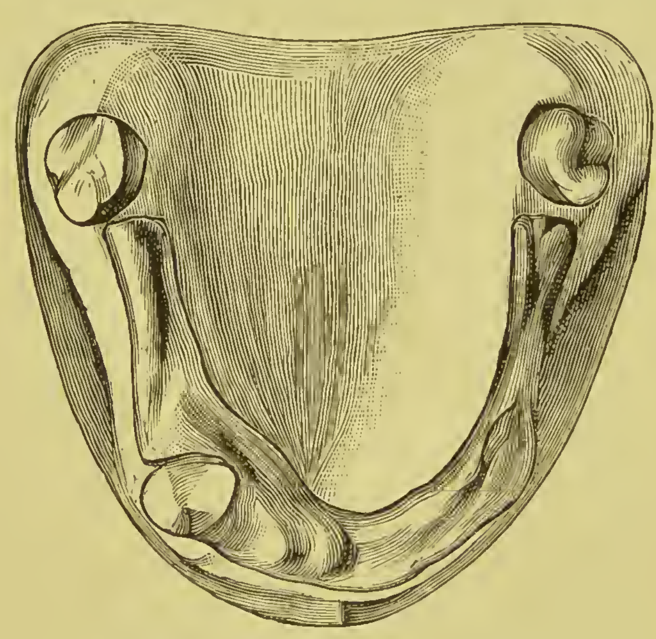

Fig. 39.

Fig. 40.

solution of borax, and fasten the two together by means of two or three clamps. Having secured them by this means, we cut some No. 2 solder very small and place the pieces around the inferior borders of the strengthener, then gently warm the plate over a Bunsen to fix the solder, after which it may be heated under the blowpipe until the solder melts and runs through to the superior border.

The plate may be of No. 7 guage and the strengthener No. 6.

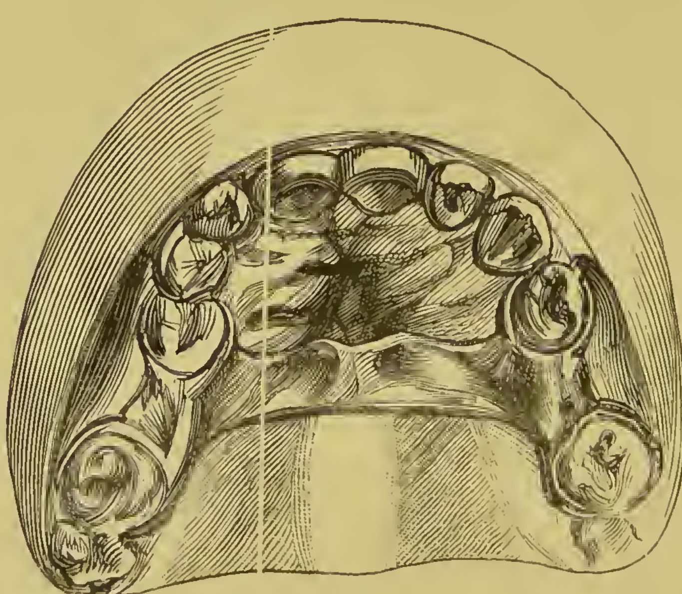

Fig. 41.

We have now to file the plate away from the teeth to allow for the clasps. In the case represented by Fig. 40 the clasps should be fitted so as to encircle the molar teeth, the division being at the distal angle of the teeth, while the clasps for the bicuspid should extend only around the back and sides of the tooth but not to appear in front. If a plate such as this is not strengthened it should be of No. 8 guage.

There are some forms of partial cases where one can bring a narrow extension across the palate, and where a plate is indicated owing to the soundness of the teeth, a case such as represented by Fig. 41 may be worn with much comfort, as it takes up very little room in the mouth, and is out of the way of the tongue. Fig. 42 represents the same off the model.

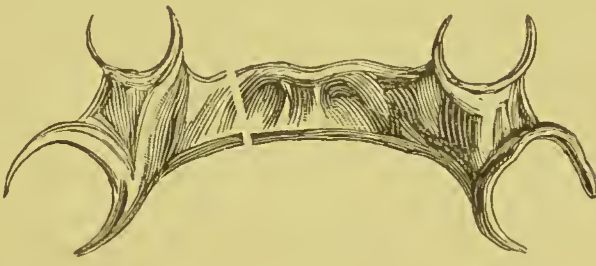

Fig. 42.

The part crossing the palate should be strengthened, thus if the plate is No. 8 the strengtheners should be No. 6 or 7.

With a case such as this the patient should be advised to be very particular in seeing that the insides of the clasps are kept perfectly clean.

If the teeth adjoining the spaces were carious, then these cases would be very suitable for bridge-work.

Comparing plate work with the so-called removable bridge work, one cannot help being struck with the great similarity that exists between the two, especially when a very narrow plate is made; in fact, a narrow plate in three-fourths of the cases that one sees illustrated would, in the writer's opinion, have been much more satisfactory in every respect, both as regards mastication and the general welfare of the patient's mouth.

With a plate resting on the gum, one must own that greater power of mastication is obtained, and at the same time the strain on the remaining teeth is much lessened, while being able to remove it from the mouth with facility, for the purposes of cleanliness, renders it hygienically, more conducive to the health of the oral cavity.

If one takes the trouble to crown the teeth or roots and utilize them for clasping, for the retention of the case, one has the most simple form of work, and at the same time the most efficient that can be constructed.

As showing manipulative ability of a very high order, some of these bridges are conspicuous, but the conclusion arrived at, from the dreadful exhibitions that have come under the writer's notice, and under that of many of his brother practitioners, is that the foundations for these pieces of work, in many instances have neither been well or wisely chosen.

This is not right, when we take into consideration the large fees usually demanded for this form of work.

It is by no means uncommon for a gold or dental alloy plate to last efficient for ten, fifteen, or even twenty years, but I will venture to say, that with bridge work, it would be a rarity indeed, if it lasted a quarter of that time.

The last case of the kind that came under notice was in many respects, if the roots were healthy at the time of its insertion, suitable for this form of work, there being the roots of the two centrals and a lateral *in situ*. The two central roots had collar crowns and pins fitted in the root, while the lateral root had a collar and crown. Now what was the condition of these roots when this case was made, I do not know ; all I can say is, that after less than a twelve months' wear all the roots became abscessed, loose, and offensive, and

on the removal of the case all the roots came away with it, and were found to be extensively absorbed. The patient paid a large fee for the work, a case of four teeth, and the result was deplorable.

This and many other instances of a worse nature prove, I think, that great discrimination and sound judgment are required in the selection of these cases.

We will now draw the reader's attention to the several forms of pivot teeth and collar crowns.

Pivot Teeth Without a Collar.

The cases suitable for this kind of work are those in which the teeth, particularly in the front part of the mouth are too badly decayed to be able to make them serviceable or presentable by filling, or they have perhaps been chipped or broken by accident, such as frequently happens to the teeth of boys at school from cricket or football. In such cases it is usual to make a deep cut or groove in the tooth, or both its lingual and labial aspects with a thin corundum or carborundum wheel, well moistened with water, and then with a pair of excising forceps remove the crowns.

Fig. 43.

If we find on using the wheel that little or no pain is caused, we may cut into the tooth to such an extent, that the shock incidental to excising the crown, will be but trivial.

Should this operation, however, cause pain, the patient may be allowed to take some nitrous oxide to complete the operation.

Before giving the gas, one should have, besides the excising forceps, a suitable drill, nerve barbs, and everything necessary ready, so that the moment the face piece is removed and the crown is cut off, a suitable instrument may be passed into the canal to remove the nerve.

In every case it is as well to make as deep a cut as possible into the tooth, as it lessens the risk of a fracture or splitting of the root.

It may sometimes be found impracticable owing to a constriction at the entrance to the canal, to remove the nerve while under gas; in such a case we may proceed, in the following manner, to devitalize it. First carefully clean the surface of the root with chloroform and thoroughly dry it. Next, take a small piece of blotting paper about twice the size of a pin's head, and place over the exposed nerve. A little Harvard or Caulk's cement should then be mixed up and carefully moulded around the paper on the surface of the root; then before it hardens, the piece of paper should be removed, and replaced by another moistened with carbolic, and on which is some arsenious acid, this latter is then covered over and sealed in with the balance of the cement By adopting these means one keeps the exposed nerve free. and avoids the risk of displacing the dressing while using the cement.

Harvard or Caulk's cement adheres very firmly to the dried surface of a root, and forms an excellent medium for retaining a dressing in such an exposed situation.

In the course of forty-eight hours, or less, the nerve will be found to be devitalized.

The root is now ready for the next operation, that is to enlarge the canal and remove by means of drills or broaches the remains of the dead nerve, then to cleanse the canal and seal the apex with a cone of gutta percha.

For tapering and enlarging the canal, removing debris, etc., the spring reamer (Fig. 44) will be found a most useful instrument.

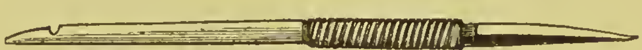

Fig. 44.

The surface of the root may now be ground on a leve with the gum at the back and slightly below the level in front, and may be conveniently done by means of a small broad

Fig. 45.

carborundum wheel. (Fig. 45.) The length of the canal in the root is next ascertained, and after the canal has been enlarged to its proper size a piece of German silver wire is filed to fit it. It is as well to have as stout a pin as possible and it should project from the root on a level with, but not above the neighbouring teeth. (Fig. 46.) This pin may be flattened at the projecting end, or have a small cross piece soldered to it (Fig. 47) so as to hold firmly into the composition that has to be used for taking the impression. Having softened a small piece of Crown composition, the thick end of

the wire is warmed and pressed into it; then the wire is pushed firmly into the root, and the composition is pressed on to the surface of the root and the two neighbouring teeth with the thumb and finger, until quite hard, the

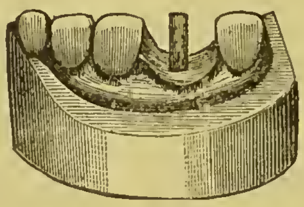

Fig. 46.

fingers having been rubbed with a little vaseline before hand. Or a strip of brass about $\frac{3}{4}$ of an inch wide may be bent up so as to form a small tray. (Fig. 48.) The smaller the tray and number of teeth taken in the impression, the better chance there is of taking an accurate model and preserving the direction of the pin in the root.

Fig. 47.

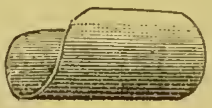

Fig. 48.

Upon the hardening of the composition the pin will be withdrawn from the mouth with the composition. Now take another piece of composition about double the size of a pea, press on the surface of the root, and get the patient to close the mouth—that is for the bite. To this impression a model may either be made of plaster of Paris, Fusible metal, or Sullivan's cement, if with the latter the model should be placed on one side to harden for at least twelve hours.

Either of these materials will give us suitable models. We now remove the German Silver pin from the model and substitute one of gold or Dental Alloy ; next we adapt a piece of No. 3 platinum to cover the root, or rather more than cover the root on its lingual, or palatal, aspect, but to be bevelled away from the labial aspect so that the neck of the tooth may fit on the root. Then drill a hole in the foil corresponding to the canal and press the fitted wire through it, and securely fix with a spot of hard wax (Fig. 49) this is then

Fig, 49.

Fig 50

invested in brick-dust and plaster and soldered. Replace the pin in the root and trim up accurately to fit, bevelling it down so that the tooth may fit on the labial edge of the root.

Now take a flat tooth of the right shape and colour, fit it to the root and adjust to the bite, back it with a piece of 18 carat gold, and then fasten it to the platinum covering the root with hard wax. Once more invest in Brickdust and Plaster, and solder with No. 2 solder flushing the solder up so as to cover the platinum, and make a biting surface. After finishing up and polishing, it is ready to fasten into the root ; before doing so, it should be tried in, and if found correct to the bite, etc., the pin may be roughened, the canal in the root cleaned out with chloroform, and then thoroughly dried with the hot blast. The tooth may now be cemented into the root with some thin oxyphosphate, introducing some up the canal

first on a broken nerve barb, and a little on the pin and tooth, and then pressing it well home. The bite should be raised so that no pressure comes upon the tooth until the cement is quite hard.

A pivot such as described will last for many years.

When taking the impression for two or more pivot teeth, and the canals in the roots are divergent, a tray should be used with a perforated back; the pins are first of all adjusted to the roots then oiled, and left projecting about a quarter to half an inch above the teeth, the perforated tray is then filled with composition and pressed up into its place, the pins passing through the perforation. When the composition is quite hard, a mark may be made with the file on the pins to act as a guide, and then they may be withdrawn. The tray is now removed from the mouth, the pins replaced in the composition, and the model cast.

An ingenious modification of this system has been invented by Mr. R. P. Lennox. It consists in having a conical cap through which the wire passes ; the cap is filled with composition, the pin is passed into the canal, and the cap pressed on to the surface of the root ; when the composition is hard the cap and pin are removed, and the surplus composition trimmed away.

The pin and cap are replaced in position, and the impression taken with a perforated tray, the pin is withdrawn through the tray, which is then removed. The pin is next placed in position in the tray, but before plaster of Paris is poured into it, a copper tube is passed over the end that goes in the root, this tube is retained in the cast, and forms a metal lining to the canal in the plaster model.

Mr. Lennox claims, and very justly, that by his system, a

perfectly accurate impression of the surface of the root can be taken, at the same time protecting it from injury by dragging against the neighbouring teeth, when withdrawing from the mouth.

Another method for making the pivot is to drill a parallel hole in the root with a straight twist drill, to the proper depth and then to countersink the surface of the root (see Fig. 51), a piece of straight wire is next fitted into the canal, and a piece of plate, No. 9 guage, like a thick washer, is drilled and made to slip over the wire and fit into the countersunk hole (see Fig. 52). This should be flush with the

Fig. 51.

Fig. 52·

Fig. 53.

surface of the root. We now fasten the pin and washer together with hard wax and invest in brickdust and plaster, and solder with No. 2 solder, (Fig. 53). After adjusting this to the root, a piece of No. 3 soft platinum slightly larger than the root is taken and adapted to the surface ; then a hole is drilled or punched in it, and it is passed over the pin, thus covering up the whole surface of the root, this is also fastened to the pin and washer and soldered, and finally burnished to the surface of the root, and over its lingual aspect.

The tooth may now be fitted in the usual manner and built up with solder. Before cementing the tooth in the root the pin should be made four sided, and slightly roughened. A very small amount of cement will be sufficient to hold it.

Crowns with Porcelain Faces.

After the sides of the root of the tooth have been reduced to a parallel condition by means of suitable wheels and trimmers an impression of it has to be taken; this is effected in a somewhat similar manner to that described for pivot teeth, that is by means of a small German silver tray, just large enough to extend across the space and overlap the half of the two adjoining teeth if present. When a division has been cut between the root and neighbouring tooth, a narrow matrix or strips of German silver should be placed in between them, before taking the impression. (Fig. 54.) These pieces

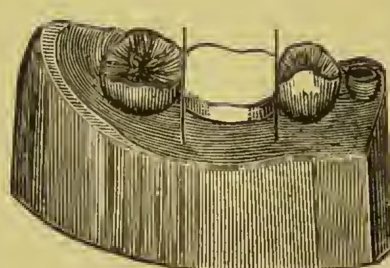

Fig. 54.

come away in the composition, and are removed after the impression is cast.

The Author usually makes his models of Sullivan's Cement (precipitated copper and mercury). It is packed into the impression pretty soft, using a blunt pointed instrument for the purpose, and then the model is placed on one side for twelve hours to harden. This makes an excellent model, but the length of time it takes to harden is a disadvantage occasionally. The other two materials used are fusible metal and plaster of Paris. Crown Composition seems to be the most reliable to use with fusible metal, but the degree of fusibility

of this latter should be ascertained or the impression may be damaged. A plaster of Paris model requires such careful handling, that the average workman is not equal to it. If it is used, it should be carefully dried and boiled out in resin and wax, or stearine. We have stated that the sides or walls of the root should be parallel; this may perhaps be better understood by the student by referring to Figs. 55 and 56.

Fig. 55.

Fig. 56.

The first represents the root in its natural condition, the second after the sides have been made parallel. In the former it will be at once seen that a collar or band, that will pass over it, will not fit it lower down, or higher up as the case may be, while with the latter a band can be so adjusted that it will slip on and off like the joint of a fishing-rod.

Where possible it is best to leave the lingual portion of the root as high as possible; this gives great support to the collar, and prevents the forward thrust of the opposing teeth from displacing it.

Where the exposed part of the root admits of a fairly deep collar, a pin in the root is unnecessary, but where the collar has to be made shallow, a pin in the canal will add greatly to its stability.

After obtaining the impression of the root and the bite, we will now presume that all the other details have to be finished in the laboratory. In order that the band may fit under the

gum, the root should be deepened by trimming away with a very sharp flat sculptor or graver a little from around its neck. We next proceed to measure it. This operation may be conveniently done by taking a piece of thin copper, or soft iron binding wire, and carefully adapting it, not only to the circumference of the root but also to the contour of the gum around the neck. This having been done the two ends of the wire are twisted together until it tightens on the root.

The wire is now carefully removed from the root and placed upon a piece of glass or paper in the same position as on the root. A little plaster of Paris should now be mixed up and poured on to the wire ring, covering it to the depth of nearly half an inch. When this has set, all the plaster

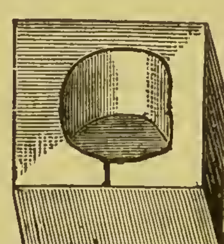

Fig. 57.

within the circumference of the wire ring is removed and likewise any excess that may have oozed under the wire, for the under surface of the wire ring represents the contour of the gum. Having therefore converted the plaster into a tube, one end of which is bounded by the wire ring, (Fig. 57), a little fusible metal is melted and poured into it, the end where the wire is, being sealed up by pressing a couple of thicknesses of blotting-paper against it. The mould should not be quite filled with metal, as any surplus has to be cut away

This operation taking as it does only a few minutes, puts us at once in possession of a hub or mandril that we can use to form and adapt the band to, and thus requires afterwards only a little fine adjustment to the delicate model of the roots. After the pouring of the fusible metal hub, the wire ring can be removed from the plaster, and when divided opposite the twisted ends, and straightened out, will give us the length of gold or other metal required for the collar. If it is intended that the two edges overlap, we must allow a slight excess over the length indicated by the wire.

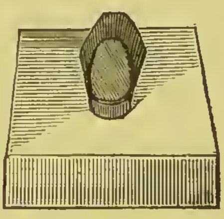

Fig. 58.

To bevel the edges and overlap them makes a somewhat stronger joint than soldering edge to edge, and when one is making a platinum crown to fuse porcelain on, this should always be done.

Having adapted the band, which should be of No. 5 guage and 22 carat fineness, to the hub, it should be held together by twisting a piece of iron binding wire around it when on the root, then removed and soldered at its lower or gum border, it may now be tried again on the model of the root.

The quality of solder used should not be less than 18 carat fineness, or if a platinum band is made it should be soldered with fine gold. After trying on the root, the collar is flared out a little at its upper border so as to conform somewhat more to the size of the crown of a tooth, and the front part

is cut away (see Fig. 58). We now have to decide whether we intend making a solid gold back to the tooth, or whether it is intended to be hollow. In the former case we must cut out a piece of gold or platinum to fit inside the collar and on to the surface of the root, thus capping it. The pattern for this piece is easily obtained by removing the band from the root, and pressing a piece of pattern lead or soft paper on to the part of the band that encircles it. A corresponding piece of gold or platinum is now cut out, the band is replaced on the root and the piece that is to form the cap is placed in position and cemented to the band with hard wax ; it is at this stage that a pin to pass into the canal may be soldered

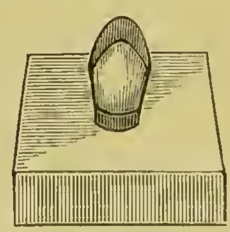

Fig. 59.

to the cap if found necessary. Having cemented the cap to the collar, it is removed from the root, and the inside of the cap is filled very carefully with brickdust or pumice and plaster, so as to prevent all chance of the solder running through and destroying the fit of the cap. After soldering, (Ash's No.2 may be used for this purpose,) it is placed in acid to clean. It is now placed on the model and a tooth fitted to it (Fig. 59). The tooth is backed with a piece of No. 8 plate, and the pins either rivetted or made half round and bent over on to the back.

When cementing the tooth into its place care must be taken

that the edges of the collar fit flush with the sides of the tooth. It is now invested in brickdust and plaster as before only in this case a little of the investment should be brought up over the cutting edge of the tooth to protect it, and if possible the joints of the band with the back of the tooth should be left exposed, so that one is enabled to see whether the solder has made a perfect joint. Before attempting to solder, one or two little shots of gold should be fused under the blowpipe, and fitted; these are to place in the space between the back of the tooth and the band, and are to help in forming the inner cusp of the tooth.

Fig. 60.

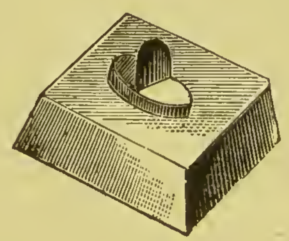

Fig. 61.

After the wax has been cleared away from the tooth, some borax is run around the inside of the collar and one of the gold shots is placed in position together with a number of small pieces of solder, it is now heated up over a Bunsen burner until red hot, and then the solder is run with the flame of a blowpipe. Another gold shot is now placed on the former, together with more solder until the cusp is built up to its required size. It is now cooled down slowly and after pickling touched up with a file and wheel and polished. This is known as a porcelain faced crown with a solid cusp.

In order to make a porcelain faced crown, with a hollow cusp, it is necessary after the collar is made, to cut away the

front part so as to be able to fit the tooth, the root is not capped all over, but may be partially, either by soldering a semilunar piece of platinum foil to extend backwards from the narrow part of the collar in front, to the back of the tooth (Figs. 60 and 61), and if it is left somewhat full and unsoldered at its posterior margin, it may be lapped slightly over the metal back of the tooth to which it ultimately gets soldered. This has the effect of strengthening the narrow band of metal that extends round the front of the tooth. This partial cap may be soldered to the collar before fitting the tooth, in the same manner as described for the full cap.

After fitting the tooth and lapping the free end of the platinum cap over the back, the tooth is cemented to the collar, which should have been flared out somewhat, and then the hollow space is filled in with wax and built up so as to form the posterior cusp and articulate with the bite. We now reduce the wax so as to allow for the thickness of a piece of No. 7 plate between it and the bite, and then we can either make a depression in a piece of lead with a suitable punch, and stamp up a piece of gold, or make a die and counter in fusible metal, or zinc and lead, building up our small model with wax or composition to permit of its ready withdrawal from the sand. When the piece of gold to form the cusp has been formed, it should be thickened by melting a little scrap gold or solder into it, and have the edges bevelled so that it fits into the collar and against the back of the tooth. We now warm the collar and remove the wax from the inside, and with the slightest amount of cement (hard wax) round the edges, fix the tooth and crown piece to the collar. A little thick borax should be pressed into the joints between the collar and back of the tooth on the inside, and also around

the circumference of the crown piece ; this is allowed to dry. We may now invest the crown so as to be able to solder it either from the inside or the outside.

It simplifies this part of the work if the soldering is done in two operations, that is to say, the tooth may be soldered to the collar first, then after cooling gradually, the portion of gold to form the cusp is placed in position, and the crown reinvested and the soldering completed.

All Gold Crowns.

The method of making an all-gold crown is to fit the collar to the root as previously described, then to flare out the sides with contouring pliers, after which wax is built up in the interior of the collar, so as to articulate with the bite, the wax is then reduced in height so as to allow for the thickness of the gold to form the crown.

A small zinc die and lead counter, or a fusible metal die and counter are now made, and a piece of No. 5 or 6 fine or coin gold is stamped up to form the crown.

This crown piece is now filled in with scrap gold and solder until it presents a flat surface. It is now adjusted to the bite and attached to the collar with a piece of binding wire or a clamp (see Section 2 Dental Laboratory), and it is then soldered, the pieces of solder after running some borax round the joint, being placed on the inside of the crown.

Perhaps a safer method, for one who is not quite up to the mark in soldering, is to bevel the edges of the crown piece so that it fits within the flared edges of the collar, and after adjusting to the bite, and fixing it in position with a little hard wax, some thick borax is painted around the joint on the

inside of the collar ; this is allowed to dry, and then the whole is invested in brickdust and plaster up to the edge of the crown piece, taking care at the same time, that the investment is carefully packed into the inside of the crown. Before commencing to use the blowpipe the metal should be made red hot over a Bunsen burner.

The soldering may now be safely accomplished from the outside, as the collar is protected from any chance of sweating by the investment.

For a further description of all gold crowns see page 111 of the Dental Laboratory.

The Author has endeavoured in this section of his work to direct the student and young practitioner to the most simple methods of working, at the same time to produce perfectly satisfactory and artistic results ; above all, it has been his aim not to perplex him with devices that are never practicable, nor sound in principle, and to avoid as much as possible using those standard specimens of dentistry, good, bad, and indifferent, that seem to have been transmitted, with one or two notable exceptions, into every book on Dental prosthesis within the memory of man.

It was his original intention to have included in this section a description of Bridge-work, but the possibilities of what may now be accomplished in this class of work, by the combination of porcelain and continuous gum, and also to avoid a repetition of the various processes, has decided him to include this branch of the Dental art in a future work.

DENTAL MECHANICS.

PART IV.

Dental Irregularities.

BY

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WITH NUMEROUS ORIGINAL ILLUSTRATIONS.

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INDEX.

DENTAL MECHANICS:

PART IV.

APPLIANCES AND DEVICES FOR THE CORRECTION OF DENTAL IRREGULARITIES.

Considering a work on dental mechanics as incomplete without some reference to guide the student as to the nature, structure, and object of the appliances used for the treatment of dental irregularities, the author is led in this section to bring before his readers some of the devices he has found most useful, both in hospital and private practice; and while he does not lay claim to any originality of treatment, he would try to draw attention to those simple forms of appliance that are most likely to be worn and tolerated by the patient, thus conducing in a great measure to the success of the operation.

There is no branch of our art that calls for the exercise of mechanical skill and ingenuity in a greater measure, than that devising the means whereby one can transform an irregular and crowded condition of the teeth, and malformed dental arches, into perfect order and symmetry. Very few of these cases are alike in detail; each requires, as it were, to

be studied and treated on its own merits. For the means to be adopted one must be guided by several very important considerations.

The first is to ascertain the willingness of the patient to submit to the various little troubles incidental to the treatment and the co-operation of the parent or guardian is also essential to ensure that the instructions given by the dentist are carried out in an intelligent manner.

The next business is a careful inspection of the mouth and to determine which teeth to retain and which to remove ; we must also well consider if the teeth we propose to remove might be made useful for anchorages prior to so doing.

Having taken the impressions, and cast the models, we have now to consider the nature of the plate or appliance.

Experience teaches us that the simpler these devices are, provided they effect the purpose they are intended for expeditiously, the more likely they are to be worn faithfully by the patient. The first consideration is, that they should not encumber the mouth so as to prevent the patient masticating his food ; the second is, that for hygienic reasons they should be easy of removal so as to be kept scrupulously clean ; and the third, that there should be no chance for the patient to insert them wrongly.

As the majority of the cases of dental irregularity are due to a contracted condition of the dental arches, the operation of spreading or expanding these arches becomes one of the most important one has to perform. We have in these cases a crowded condition of the teeth, some overlapping the others, some perhaps crowded out, either inside or outside the alveolar ridge, but in each case, if our object is to make the teeth assume their normal positions in relation to the

others, we must in the first place make room for them, by using some appliances that will keep a sufficient pressure on the inner sides of the alveolar borders that will enlarge or spread them to the extent necessary.

For expanding a contracted arch, one of the most effective and simplest methods is to use a split vulcanite plate joined together by a screw running in two german silver tubes vulcanised in the substance of the rubber. As these tubes are usually covered by the vulcanite, german silver of the best quality will be found a very suitable material to make them of; there is a further advantage in using this material, that it can be procured in sizes such as we require for the purpose.

In order to make these appliances, it is necessary to provide ourselves with a screw plate and taps. Armed with these, we first run a thread on a piece of german silver wire about an inch long. The next process is to tap the tube, this may be accomplished by taking a piece say about one and a half inches long, into one end of which a piece of wire is placed; we can now hold the tube firmly in the vice without danger of crushing it, during the process of tapping. The steel taps for doing this can be conveniently held in a small hand vice, and then screwed with a to and fro movement into the tube, using plenty of oil.

When a sufficient length of tube has been tapped, the german silver screw should be screwed into it to ascertain it it works smoothly, it is then removed and the tube sawn through with a fine saw into two equal parts, these are then replaced on the german silver screw, and the screw and tubes filed or cut to the length required. A few irregular marks with a file will be sufficient to retain the tubes in an upper

Fig. 1

vulcanite case, but in a lower when the screw and tubes are prepared, wings of german silver are soldered to the tubes.

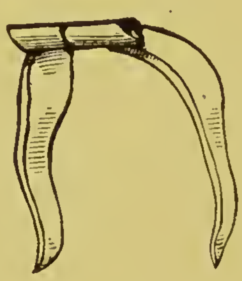


Fig. 2.

These wings should be close to the necks of the teeth as far at the distal extremity of the anterior molars.

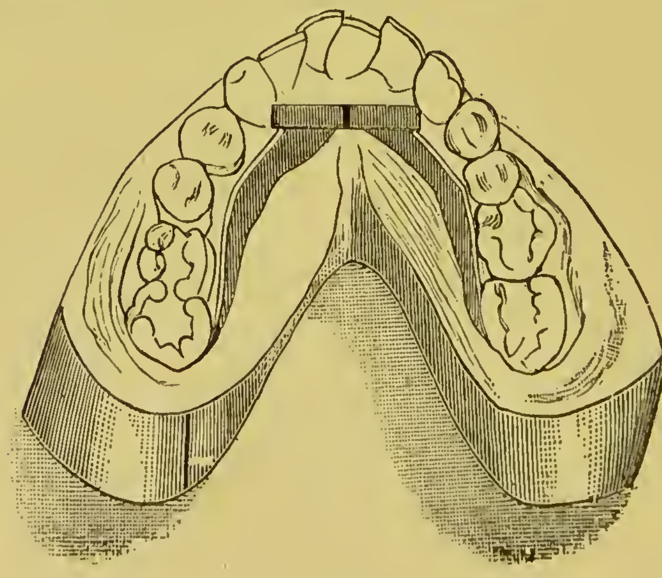


Fig. 3.

When soldering the wings on it is safer to withdraw the screw from the tube or else lubricate it with a little whitening to prevent its being fastened to the tube. The screw and tubes may be gilded prior to insertion in the vulcanite if thought necessary.

The advantages of a screw such as described are, that it retains its steadiness and usefulness much longer than those inserted in vulcanite without the tube, and also, when the plate has been expanded to the extent of the screw, it can still be partially unscrewed from the opposite side of the case to allow for further expansion, or a new and longer screw can be inserted without making a fresh case. Being covered by the vulcanite, there is nothing to interfere with or to cause irritation to the tongue.

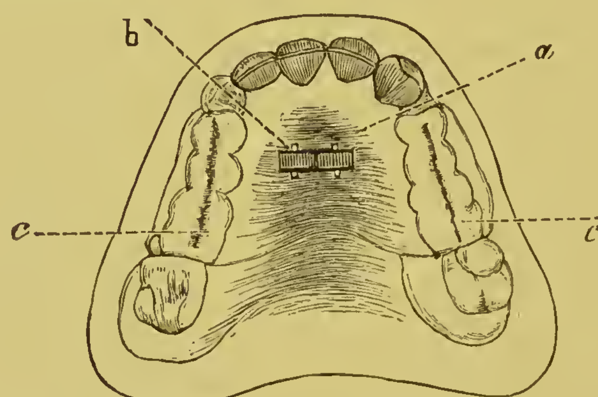
It has the still further advantage that one can, with safety, send the patient away for four or five weeks, if necessary, after giving instructions for the unscrewing of the plate about every four days or as often as the pressure can be tolerated.

A very neat and strong split-plate may be made in the following manner:

Get zinc dies and lead counter of the model, and swage up No. 7 gold or dental alloy plates to cap the molars and bicuspids where necessary. (See Fig. 4). The plates should overlap the crowns of the teeth about one-eighth of an inch, and before the final swaging, these overlapping edges may be nicked with a piercing saw or pair of sharp shears, after which they receive the final swage. The plates are now to be cleaned and annealed, and after the overlapping edges are turned outwards slightly, to allow the vulcanite to take a good hold of them, they are ready to adjust to the model.

We now take the model, warm it, and paint it with chloro-

rubber over every part where the plate has to extend, likewise under the edges of the plates. These latter are now warmed and placed in position. A sheet of rubber is now cut roughly to a pattern made on the zinc model, and having been softened either on a hot plate or over a spirit lamp, it is carefully pressed into the palate, and up to the edges of the plate, other smaller pieces are then adapted to the buccal aspects and pressed around the edges of the plates, and afterwards smoothed by being rubbed with a pledget of wool soaked in chloroform.

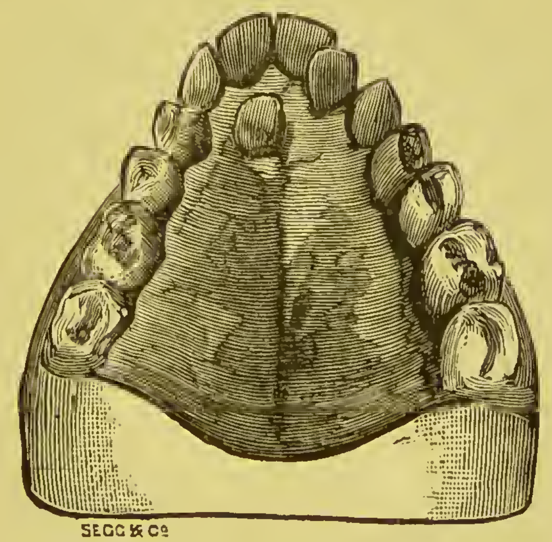


(Fig. 4). a Rubber plate.
b Screw tube.
c c Dental Alloy plates.

We have now to insert the screw and split tubes into the rubber in the palate of the case (Fig. 4, b), to do this it is first necessary to build up pieces of soft rubber the required height, then, after warming the screw to press it into the position required; it should be perfectly straight across the palate. We next take more soft rubber, build it up around, and just to cover the screw, and then finish up the palate with chloroform the same as the sides. When this has been done, one should take a warm knife and make a deep cut in the

rubber plate extending from behind the front teeth to the posterior edge of the palate. The plaster running into this cut, enables one when the case is finished to divide it more easily.

The case is now ready to be inserted into the flask for vulcanizing. As all the packing of rubber has been accomplished, it only remains to dip the model into cold water, and then having mixed up a sufficient quantity of plaster of Paris to fill the flask, the case is inserted and the flask is closed.

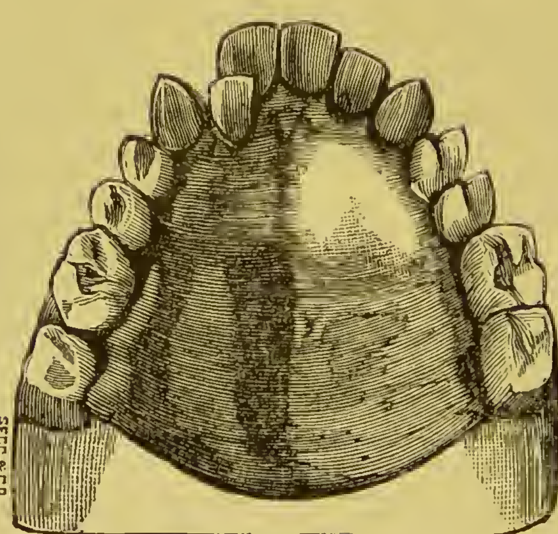


(Fig. 5). Original condition of the Mouth.

As a rule the rubber itself may cover over the teeth, and be cut away if found necessary to allow the cusps of the teeth to appear through; this however, weakens it considerably, and the portions of the case in the buccal region are apt to break away. There is no fear of this occurring when a plate is swaged up to cap the teeth.

In the foregoing description the making of an upper case has only been described, the same course may be adopted for

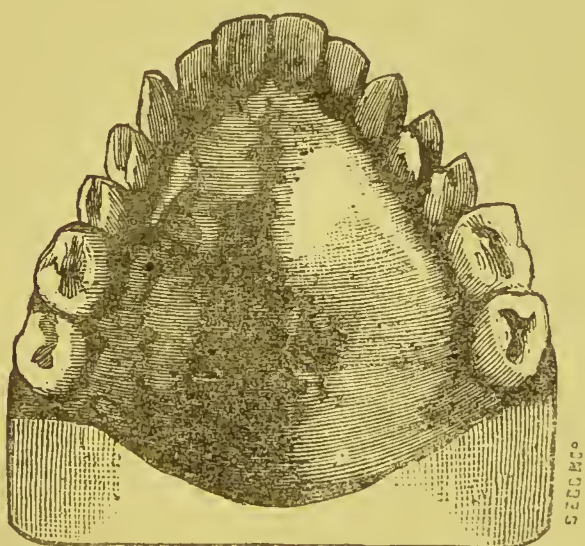
the lower, the only difference being that the screw instead of crossing as in the upper, is placed close behind the front teeth, and wings of German silver are soldered to its distal extremities, and extending to the anterior molars, (see Fig. 3), in order to give strength and rigidity to the ends of the rubber plate, and equalize the expanding power of the case. The packing of the rubber on the model, and subsequent finishing off with a warm instrument and chloroform, is the same as in the first mentioned case.



(Fig. 6).

After being vulcanized, and cooled down, it is removed from the flask, then filed up and polished before attempting to saw it in half. When this is done it is ready for the mouth. As a rule the fit of a case made on this principle is perfect, and the articulation is not materially affected by the plate covering the teeth, there is also no fear of a fracture as occasionally happens, when the vulcanite itself is brought over the teeth.

Figs. 4, 5, 6, will shew the effects of a screw plate such as described, with but a small amount of attention from the dentist, and that only towards the completion of the case when the right lateral was drawn into position, by lacing with rubber dam.



(Fig. 7). Case when completed.

When inserting such a case in the mouth, the patient should be directed to wear the divided plate for a short time before commencing to separate it, after which he may make one turn of the screw every third or fourth day, so as to ensure constant pressure being kept up. He should also be advised to report himself in from three to four weeks' time or longer, according as a small or large amount of expansion is required, and if the patient has been faithful and performed his part of the contract, a great improvement ought to be visible.

When a patient has to come a long distance, this method of treating a contracted arch will be found peculiarly advantageous, at any rate from the patient's point of view.

Another method for expanding the Dental Arch is by means of a split vulcanite plate with a spring in the centre, known as the Coffin plate. This is also most effective and reliable, but certainly requires greater attention on the part of the dentist, as the spring is apt to get broken if meddled with by the patient.

The following method is recommended for making a split vulcanite plate. First dry the plaster model, and cut out a pattern the size of plate required, and while still warm paint the former with a solution of chloro-rubber to the extent of the rubber plate required.

Fig. 8.

A piece of rubber is now cut out according to the pattern, and is softened on a hot plate and pressed into the deeper portions of the palate, afterwards to the teeth and alveolar ridges. A piece of pianoforte wire is then bent to the required shape (Fig. 8) with suitable round-nosed pliers, and after coating the free ends, which are to be inserted in the vulcanite, with tin in order to prevent the sulphur from acting on the steel, they are pressed into the soft rubber and secured, the spring being thus close to and on the surface of the plate, which should be covered with a layer of tin foil to prevent the sulphur in the rubber from acting on the wire. Before inserting the spring into the rubber it may be held together with binding wire. It is then flasked and vul-

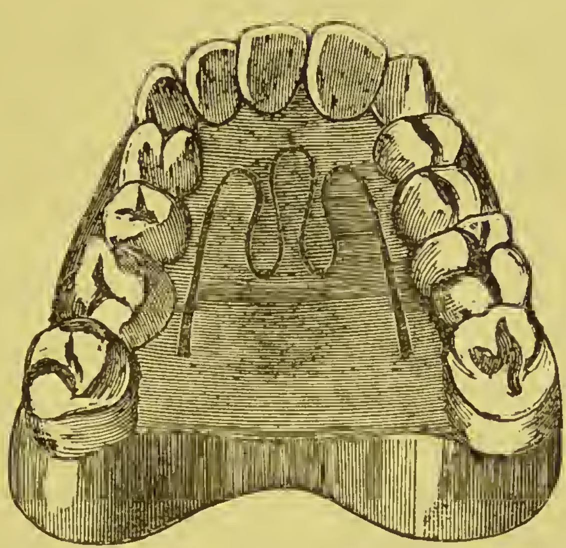


Fig. 9.

Fig. 10.

canized as directed for the screw-plate previously described. This plate when filed up and polished, may in some cases be worn for a day or two before dividing it, as it enables the

patient to get used to the feel of the case in the mouth before any pressure is applied. For tinning the ends of the wire for insertion in the rubber, a little tin or soft solder may be melted on a piece of brass or copper plate, having a slight indentation hammered in it to prevent the tin flowing about.

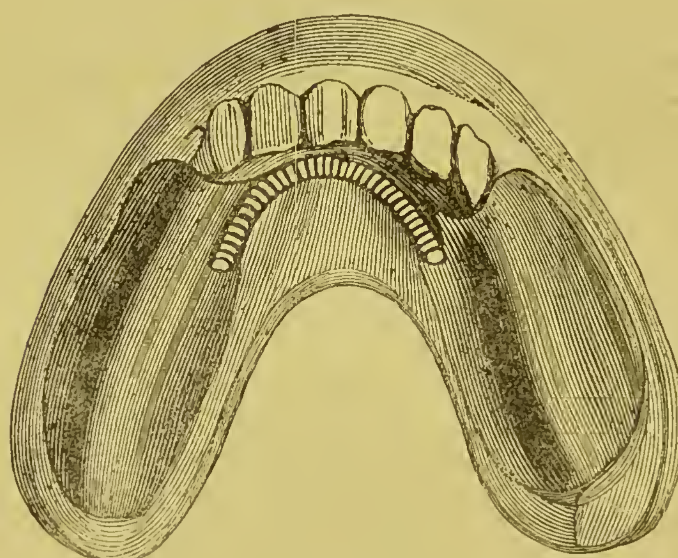


Fig. 11.

The ends of the wire after being flattened should be just touched with zinc chloride and then dipped into the melted tin; this will coat and protect it. Fig. 9 shows the position of the Coffin spring in the palate of the case, the flattened ends of course should be covered up in the rubber, and care should be taken that the spring takes the slant of the palate, and that it does not stick out at the back part, to get into the way of the tongue.

Fig. 10 is the model of the lower jaw of a young lady about fifteen, whose molars and second bicuspids slanted into the mouth to such an extent that it was only possible to take the

impression in sections. In order to make a case that should admit of easy removal and insertion, to correct the position of the offending teeth, two side-pieces capping the molars and bicuspids were made ; these were connected by a pair of spiral springs, (Fig. 11) which were vulcanized into them. Fig. 12 is a view of the device off the model.

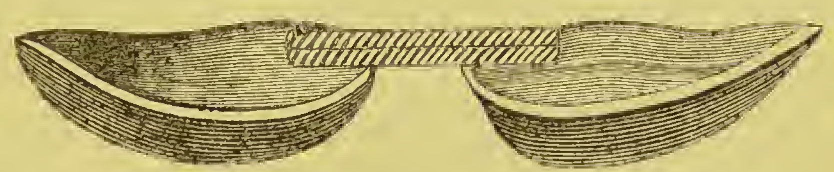


Fig. 12.

Very good results followed the use of this which was worn until the position of the teeth admitted of the use of a screw plate.

Other devices for expanding the dental arches are the Talbot Regulating Springs* (Fig. 13-14). These give us a power much more under control than a spiral spring, inasmuch as the pressure can be exerted (by a propor adjustment of the arms) both at the anterior as well as at the extremities of the spring.

This appliance is best used in conjunction with light vulcanite plates (Fig. 15), to which the spring may be attached by ligatures, or preferably vulcanized in, the same precaution being taken as in the case of the Coffin spring, to tin the part that is inserted in the vulcanite.

The vulcanite plates give a better bearing surface against the teeth and prevent displacement. Modifications of both

*Harris's Principles and Practice of Dentistry.

this and the Coffin Spring may be used for separating, as well as drawing teeth together.

We will now turn our attention to those cases where we have to push or draw into position individual teeth ; this operation may be effected either by pegs, springs, ligatures, elastic bands or screws.

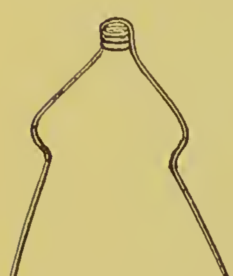


Fig. 13.

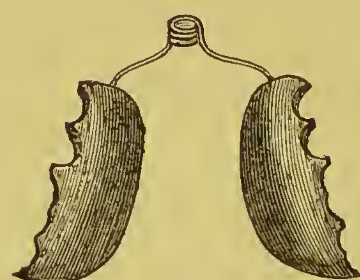


Fig. 15.

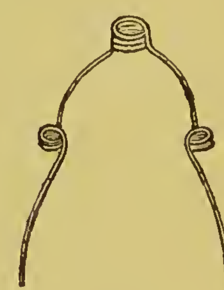


Fig. 14.

Fig. 16 is a simple case of pegging ; in this case the teeth were only partially erupted, and consequently very short; the plate has been cut away somewhat in the drawing to show the position of the pegs, which were lengthened as the teeth moved.

With ordinary drawn hickory pegs left projecting from the plate, one is able to make a case that the patient can remove and clean ; this being a hospital case rendered it even more necessary to place no obstacle in the way of so doing.

To use compressed wood for the same purpose, one ought to be able to ligature or clasp the case firmly to the teeth to prevent any movement taking place when the wood expands,

and care should be taken to select such teeth as will resist the force that is exerted when the wood gets moistened.

To illustrate the amount of force exerted by compressed wood, one has only to take, say, a piece of deal or willow about $\frac{3}{4}$ of an inch square. Now place the piece in a vice with

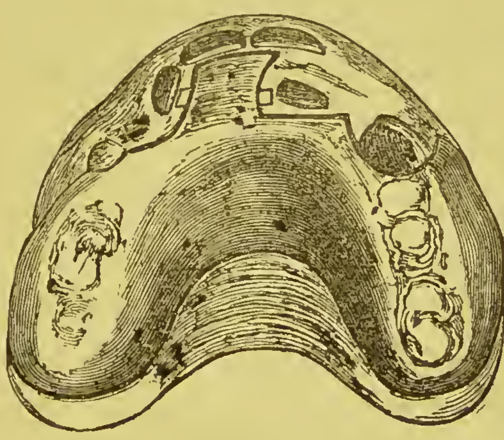


Fig 16.

the grain of the wood parallel with the jaws, and then compress until it is reduced to one half its original thickness. Next with a fret saw cut narrow blocks across the grain, and file these up until about the size of the hickory pegs sold at the depots for regulating purposes.

We will now take an ordinary vulcanite plate and drill a suitable chamber in it, to allow the compressed wood to be inserted, and to come flush with the surface of the vulcanite. If we place this plate in water we shall find in twenty four hours or even less, that the wood has expanded to its former length, and now projects one half from the plate. Instead of a hole drilled in the vulcanite one can have a dovetailed slot to contain the compressed wood. The slot should be widest

where it impinges on the tooth and should taper both upwards and backwards.

The rapid expansion of compressed wood to its original length proves most conclusively that the plate should be firmly secured to several strong teeth, to resist the force at any rate until the tooth begins to move.

With short teeth, pegs are often more useful than springs, as they are not so likely to get disarranged or misplaced. In all cases it is as well that the bite should be so raised that the tooth or teeth to be operated on may pass freely forward without coming into contact with the opposing teeth. In some cases, more especially in the upper jaw, where a front tooth has a decided slant inwards, a peg cannot be used with effect, as the projecting peg would not clear the point of the tooth and touch the back. This is a case in which compressed wood could be employed with advantage. Nor is a tooth with much of a slant outwards suitable for pegging, as there would be a tendency to shorten it instead of pressing it forwards.

In the first of these cases we may also adopt the following method.

Dry the plaster model and while warm paint it with chloro-rubber, then adapt a soft rubber plate to it to the size required, bringing it over the molars and second bicuspids. Next take a piece of hard gold or German silver wire about half the thickness of pin wire and bend it so as to conform to the arch of the front teeth.

The ends are now flattened, and after being warmed are pressed into the soft rubber and vulcanized. Fig. 17 represents such a plate. When finishing the plate up the rubber is cut away from the back of the misplacod tooth, and a small

India rubber band made from a piece of Maw's feeding bottle tube, is passed round the wire and threaded through itself, so forming a little loop which can be stretched over to make the necessary traction on the tooth. A convenient way for drawing the loop of rubber over the tooth is to pass a little piece of thread through it; the thread enables the patient to stretch the elastic ring, and to draw it over the misplaced tooth, and renders the operation simple.

Fig. 17.

Another method by which upper centrals within the arch can be brought forward is by means of what is known as an inclined plane, (Fig. 18.) This is practically an elongation of the opposing front teeth made by bringing the vulcanite over the points of the lower centrals and slanting it inwards in such a manner that it will strike behind the upper tooth or

teeth, on closure of the mouth. As these loosen by the pressure, they slide forward and outwards along the plane, and in

Fig. 18.

the course of a short time get sufficiently advanced for the lower teeth to pass behind them ; the length of time required

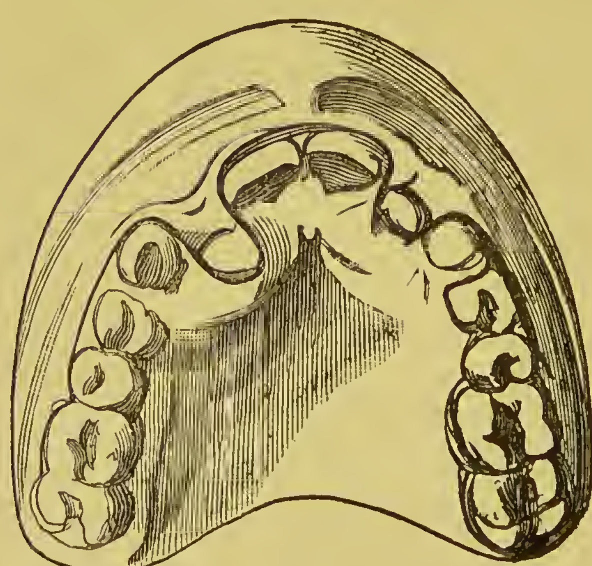


Fig. 19.

depends in a great measure on the amount of force exerted by the patient in closing the jaws.

When the teeth are sufficiently advanced that the lower

centrals past behind the uppers, the operation may then be regarded as complete.

The advancement forward of a tooth within the arch may also be affected by a strip of rubber dam, this should be

Fig. 20.

ligatured to the teeth on either side of the misplaced one, and then drawn in and looped over it, (Fig. 19).

In applying the rubber, a strip about three inches long and an eighth of an inch wide may be taken and securely ligatured to the teeth on one side first, then having passed the silk twice round a bicuspid on the other side of the mouth, the rubber is put on the stretch and held either by the patient or an assistant, while it is included in the ligature around the bicuspid.

As it is now under considerable tension, it has to be drawn into position and ligatured to the teeth adjoining the offender,

and it may then be drawn through the space and passed over the misplaced tooth, and secured so that it cannot slip off. The contractile power of a slip ot rubber dam may be used either for elongating or shortening a tooth, by attaching it under tension to the neighbouring and then drawing it down to, (or above, if in the upper jaw) the tooth that has to be lengthened, and attaching it to the same by a ligature.

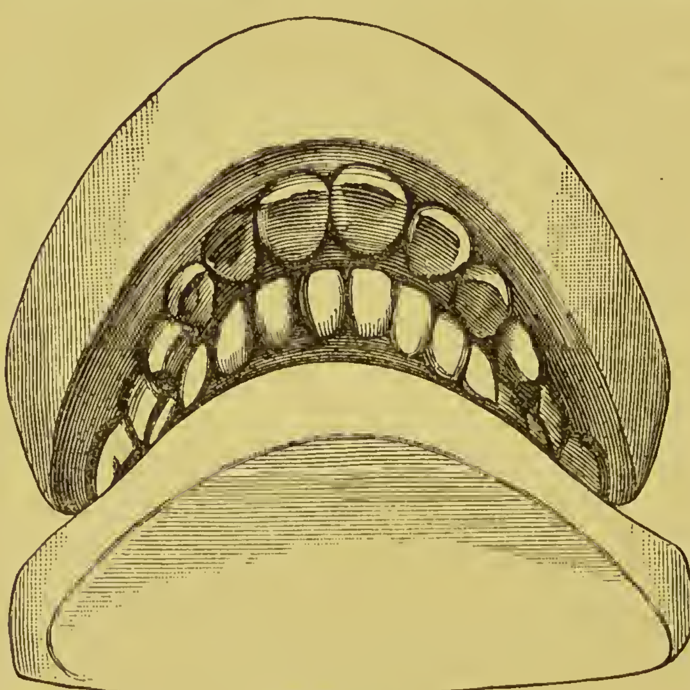


Fig. 21.

If a tooth has to be shortened, the rubber may be attached to the necks of the neighbouring teeth, and then stretched over the point ot the tooth to be shortened, this will bring a considerable amount of pressure to bear, if the rubber strip has been made tense.

ANTERIOR PROTRUSION.

The following cases will serve to illustrate two of the most effective methods for remedying this condition of the teeth,

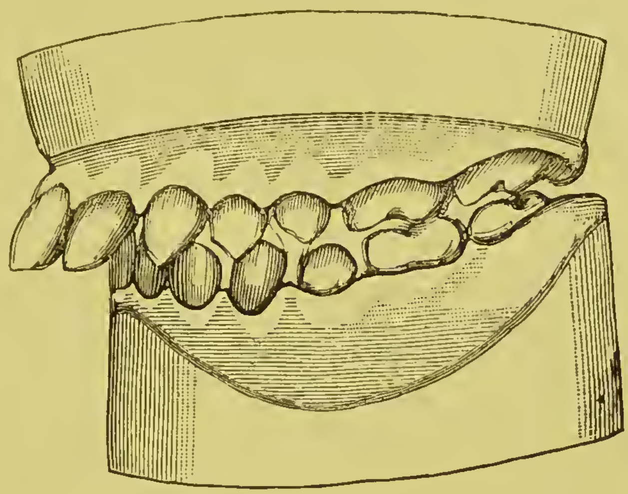


Fig. 22.

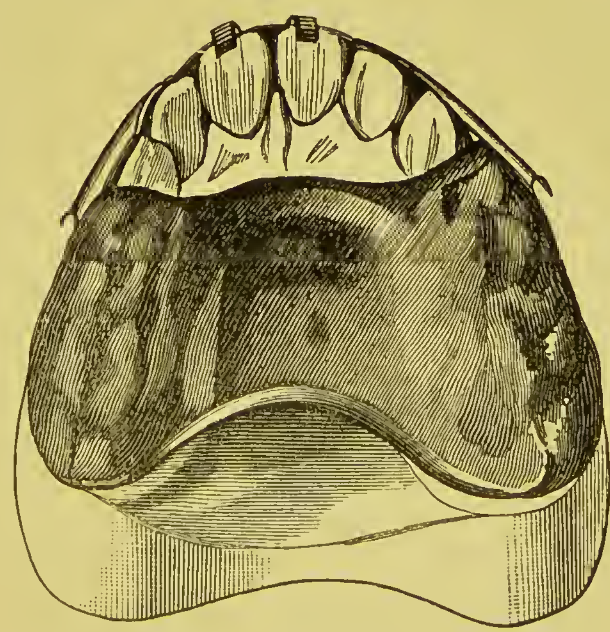


Fig. 23.

These two cases are somewhat interesting, as being those of two sisters; they were both treated together, so that a fair comparison could be obtained of the methods adopted.

Fig. 20 represents the mouth before operations. Fig. 21 is the same model articulated with the lower, and shows the projection of the upper teeth. Fig. 22 is a lateral view of the

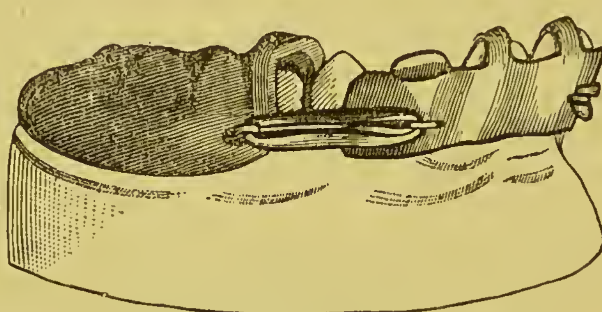


Fig. 24.

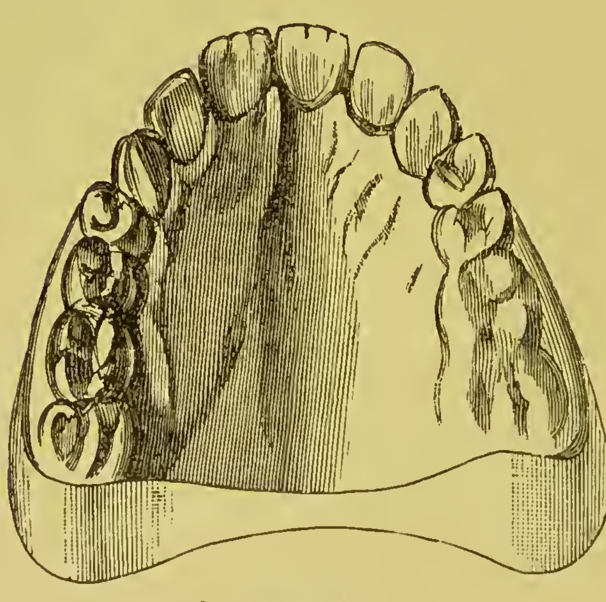


Fig. 25.

same. Fig. 23 shows the appliance made to correct the irregularity, Fig. 24 being an outside view of the same.

The appliance consisted of a vulcanite plate covering the back teeth on either side, and into the buccal borders little loops were vulcanized, these were to fasten the rubber bands to.

An impression was now taken of the faces of the six front teeth, and from the resulting model a zinc die and counter were obtained. A piece of dental alloy was struck up to the teeth, (see Fig. 24), and it will be noticed that two small extensions loop over the points of the two front teeth, the object of these pieces is to prevent the plate from slipping up and cutting into the front gum. Two loops were soldered to

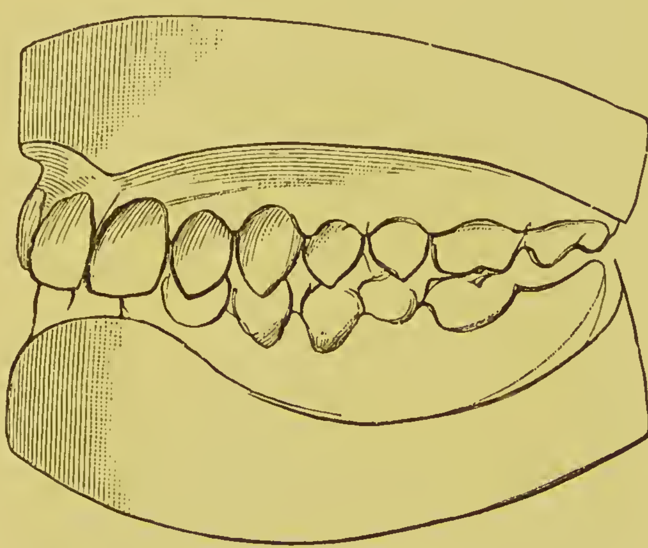


Fig. 26.

the upper and distal extremities of this plate, in a line corresponding with the loops on the vulcanite plate, so that the two pieces could be attached by small india rubber bands. In this

case the traction was increased by using smaller bands, as the teeth moved, and was sufficient to draw the teeth into the position shown in Fig. 25 and Fig. 26 in less than five weeks. They were not only brought fairly in to a normal arch, but somewhat shortened.

When treating a case on this principle, it is as well to show the patient how to apply the rubber bands and renew them when necessary, more especially it an interval of two or three weeks has to elapse before seeing her again.

Some idea of the condition of the mouth of the second sister may be gained by a glance at Figs. 27, 28, 29, and

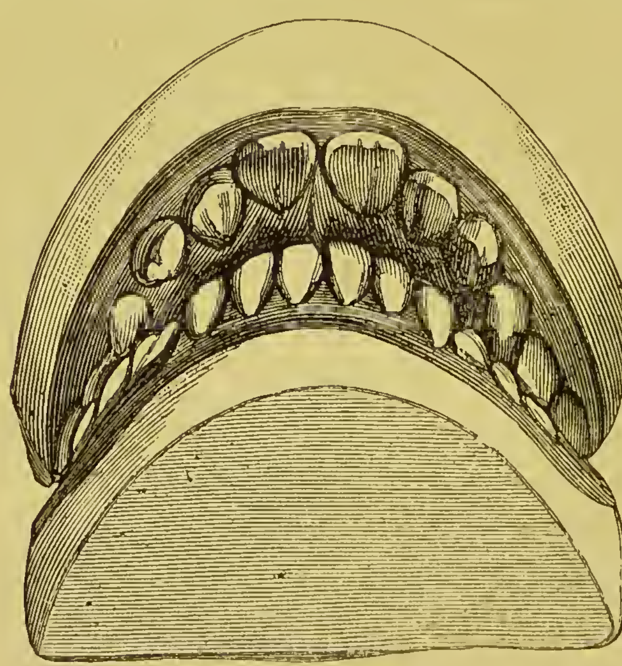


Fig. 27.

strange to say an equally good result was obtained, as in the first mentioned case, although the means employed were so different.

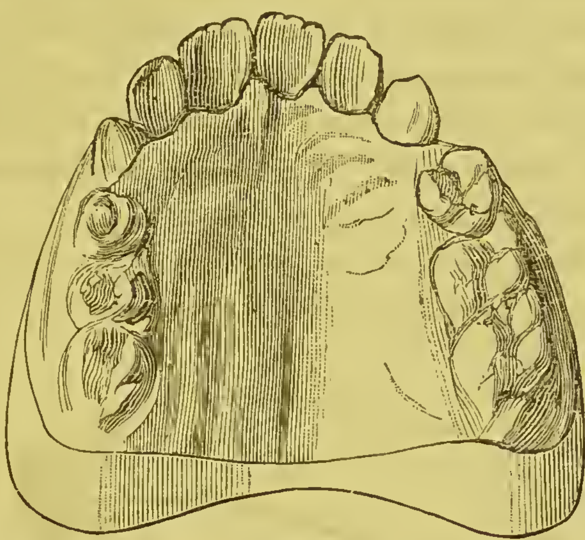


Fig. 28.

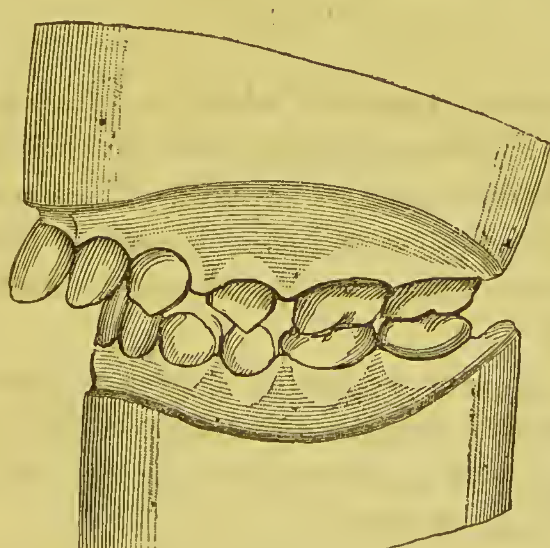


Fig. 29.

The appliance consisted of a vulcanite plate covering the palate and back teeth, and having extended from its anterior buccal aspects two strong springs made of hard 16 carat gold wire. In order to still further increase its elasticity it was reduced by being pulled through the draw-plate three or four holes without annealing afterwards.

Fig. 30 shows the position of the springs which were bent in from time to time to increase the pressure.

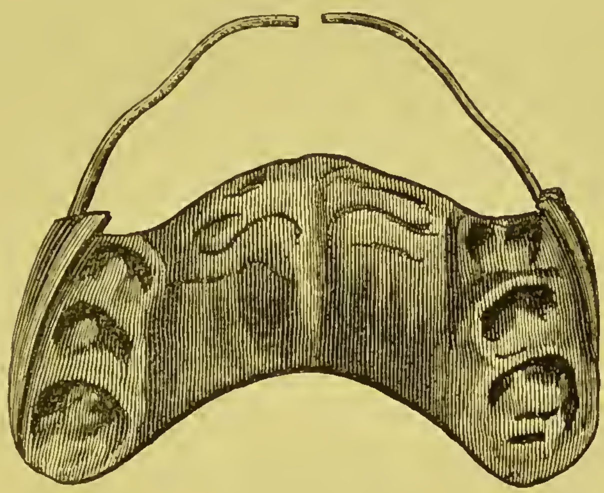
Fig. 30.

Fig. 31 shows the plate as a whole, a portion of the palate at the back of the incisors having been cut away so as not to interefere with their progress inwards. There was palpably no difference in the time occupied in getting the teeth into position, and each sister was supplied with a retention plate at the same time.

The retention plate consisted of a thick vulcanite denture covering the palate, into the extremities of which a gold wire was vulcanized; this came round the faces of the teeth and rested firmly against them.

Figs. 32 and 33 were drawn from the models on completion of the case.

In both these cases we were fortunately working under the



Fig, 31.

most favourable conditions, in as much as the anchorage on

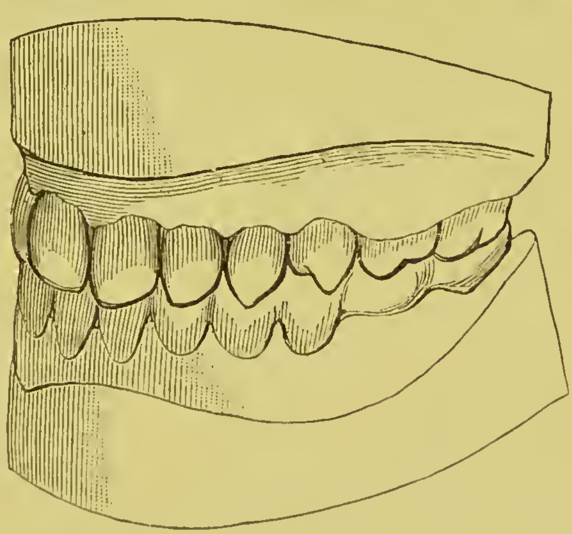


Fig. 32.

the teeth at the back of the mouth was ample for drawing the front ones backwards and inwards. In those mouths where

such is not the case, say where one has to extract the six year old molars and press the bicuspids one tooth backwards, a different method must be tried. Supposing one has only the second molar teeth, the first having been recently extracted, it is as well to begin operations by wedging the the second bicuspids. These will usually yield very readily if

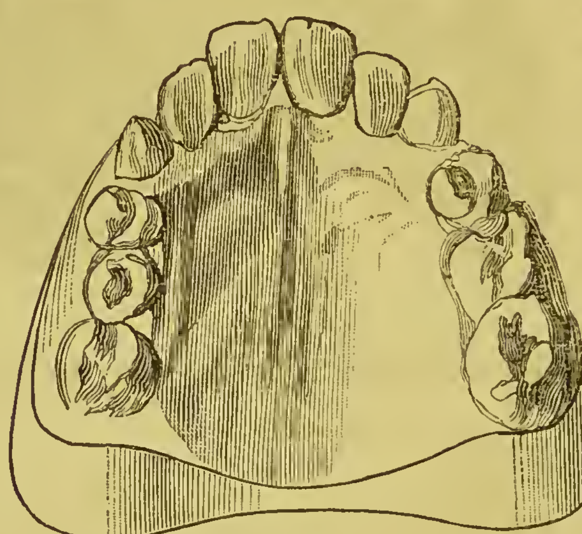


Fig. 33.

one uses the triangular rubber strips sold at the depots for this purpose, of course beginning with a strip of moderate thickness, and then increasing it. These teeth should be moved backwards in this manner until a fair space is obtained between them and the first bicuspids. Leaving the wedge between the two bicuspids we next turn our attention to the canines, and proceed to wedge the first bicuspids after the second until a good space exists between the canines and the first bicuspids. In about a fortnight it will usually be found that a space equivalent to one tooth has been obtained,

and that without interfering in any way with the second molars. Now to complete the operation and secure the space obtained, it will be found necessary to make a vulcanite plate to cover the palate and the second molars, which have now to do their share of the work by forming an anchorage to draw the first bicuspids (already loosened, and moving backwards) close up to the second. A very efficient way to do this, is to make a collar to fit the first bicuspid, leaving a little loop soldered to its lingual and labial aspects, to which strips of rubber dam can be fastened, and then ligatured to the vulcanite plate on either side of the second molar tooth. The traction exerted by these means will in a week or less bring the first bicuspid against the second, and secure the amount of space required for the bringing in of the six front teeth.

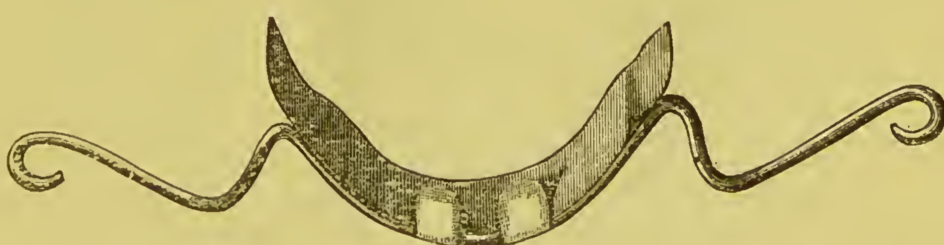


Fig. 34.

It is well when this has been effected to make a retaining plate, and let the mouth have a rest, say for three months, in order that the bicuspids may settle firmly in their sockets. After which one or other of the two methods previously described may be applied to their treatment, and that under favourable conditions.

Should it be necessary, however, to proceed with the operation immediately on securing the necessary space by

wedging the bicuspids, we may proceed to construct an appliance that will enable us to effect our object without in any way requiring anchorage at the back of the mouth. Such instrument will perhaps be best explained by consulting Figs. 34 and 35. The former is simply an appliance similar to Fig. 24, but with two extensions made in thick German

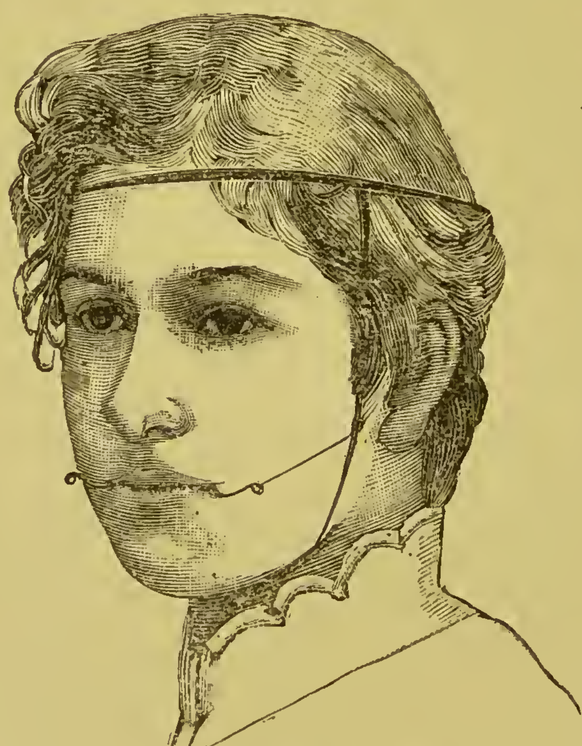


Fig 35.

silver; these extend in two loops and are shewn in position in Fig. 35. This illustration may be to some extent misleading, inasmuch as the artist has not given prominence to the teeth that would warrant a dentist's interference, and at the same time a ribbon should be attached to to that coming down in front of the ear, so as to pass ust under the ear and fasten at

the back of the neck. The band going round the forehead should be represented by a skull cap made to accurately fit and to which the ribbons, to make firm, are secured. A fixed point in front of the ear can thus be obtained and elastic bands can be secured to this point and fixed to the loops at the angles of the mouth. As an appliance such as this is rather conspicuous, it may be worn always at night and other times when convenient, and it is a very effective way for employing force where there is insufficient anchorage in the shape of teeth at the back of the mouth. This question of anchorage is one that should be taken into serious account and recognised by the student, as the forward advance of the second molars into the spaces occupied by the first, without gaining the necessary room for the bicuspids, makes a condition of affairs that is somewhat difficult to remedy.

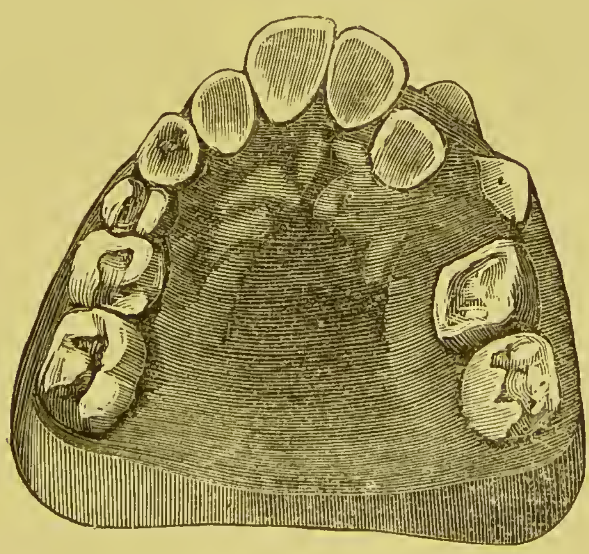


Fig. 36.

Fig. 36 is an illustration of a not uncommon form of irregularity. In this case, owing to the crowded state of the

mouth, and the broken down condition of the lower seven year old molars, symmetrical extraction was decided on, but before losing the teeth it was seen that they could be made of considerable use, not only as attachments or supports to the plate, but also as anchorages, more especially the one on the left side, from which to apply force to draw back the bicuspids and canine tooth.

On looking at the diagram it will be seen that the two second temporary molars are in position; these were removed. By their removal we gained a space equal to a third of their size on each side, or in other words the second bicuspids which erupt beneath them, are about that amount smaller, this gives us some room which, in normal mouths, is sufficient for our wants, but in this case it was not.

An impression of the mouth was then taken and the model

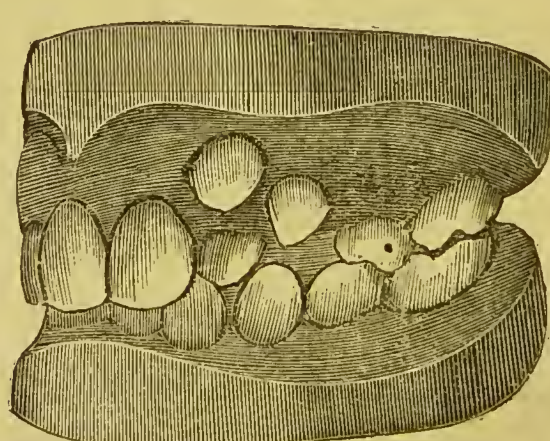


Fig. 37.

cast. Fig. 37 is a side view of the case, and it shows the left lateral within the arch, and locked by the lower canine. The upper canine is in front of, and slightly anterior to the lateral,

and the first bicuspid practically occupies the place of the canine.

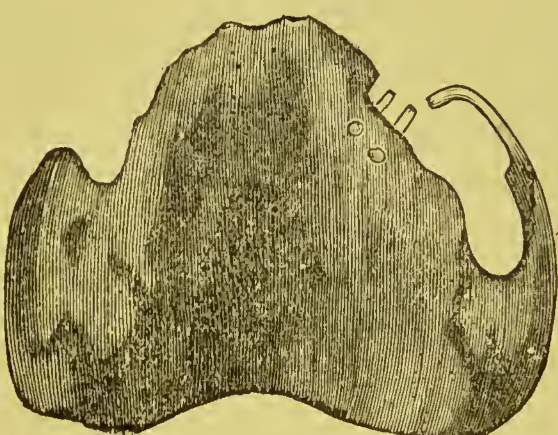


Fig. 38.

A vulcanite plate was first made to raise the bite, and a piece of spring gold was vulcanised in, and bent so as to bring pressure and some slight amount of traction on the canine A peg was next inserted to act on the lateral, and so press it into its proper place.

Fig. 39.

The action of these two forces was sufficient in a few days to push the lateral outside the lower tooth, and to bring the canine against the bicuspid.

It was now resolved to make another plate, and to use pegs to accomplish the remainder of the work, as their action on the small portion of visible tooth was more certain than a spring. Fig. 39 is an illustration of the second plate made. A small peg was first of all inserted in it, to act on the bicuspid and press it backwards ; this it did most effectually. Next this portion of the plate was filed away and a peg inserted to act on the canine ; this peg is shewn in the figure. The front, or labial portion of the plate was made thin and light and its elasticity acting on the peg was sufficient in a very short time to bring the tooth into the position as seen in Fig. 40.

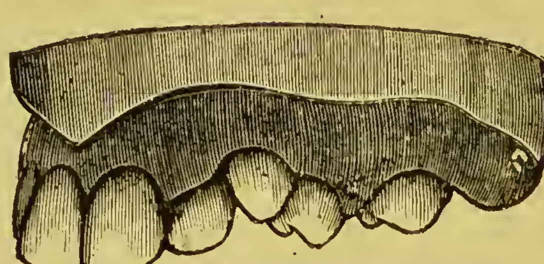


Fig. 40.

Having thus made all the use we could of the first permanent molars, they were then extracted, and Nature was left to do the rest, the plate being used as a retention plate. The action of the peg against the canine had one good effect that was not foreseen. Before commencing the work the two central teeth had a decided bias, or leaning over to the

left side ; after the operation I was pleased to find that they were perfectly straight. This, of course, was due to the pressure excited in forcing back the canine, and was an advantage one had not anticipated.

The following case (Fig. 41), is that of a young lady of

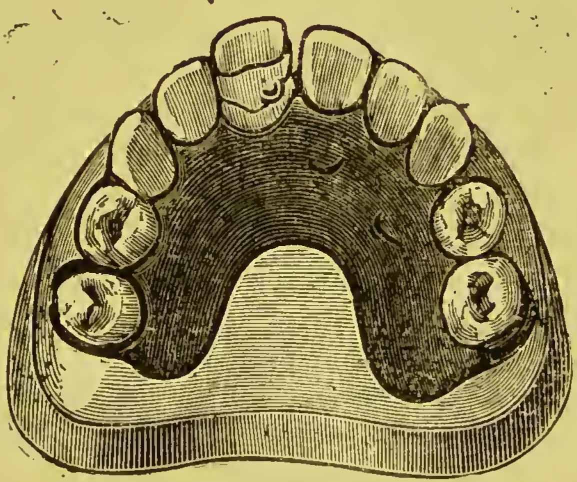


Fig. 41.

twenty-four, whose right central was being pressed outwards and away from its neighbour. As she had a great objection to anything in the shape of springs or bands being visible, the following treatment was adopted.

A dental alloy plate was made with clasps to encircle the bicuspids on each side. Then a fine silver band was adapted to fit the front tooth, and was cut away to about one-sixteenth of an inch where it came round the front of the tooth, thus presenting very little for observation. On the palatine aspect where the band was left broader, it was nicked with a sharp pair of shears and lapped to fit the back of the tooth, this was

quite sufficient when the band was soldered up again, to prevent any slipping on the tooth when traction was put upon it.

Fig. 42 shows the band on the palatine, and Fig. 43 the same on the labial aspect.

Fig. 42

Fig. 43.

In Fig. 42 will be seen the little loop soldered to the cervical margin cf the band. In the palate of the case two holes were drilled, into which two pieces of wire were soldered; these were bent so that a band could be looped over the one more distant, whilst the other kept the band on to the surface of the plate.

An india rubber band cut from a small rubber tube was now ligatured to the loop on the band, and the other end of the band was passed over the last wire hook on the plate and then pressed under the other. The plate was then inserted in the mouth, and the metal band was drawn forward and passed over the offending tooth. As the silver was left with a dull surface, it was scarcely noticeable, and in about eight or ten days the tooth was drawn into position. The band encircling the tooth was then soldered to the plate, which then did duty as a retention plate.

The band also acted as an inclined plane and pressed the opposing tooth out of dangerous contact.

If India rubber bands are employed in cases such as the one illustrated and in a similar manner, there can be no possible objection, it is when they are left unguarded that

the danger comes in, and too much care cannot be exercised by the teacher in bringing these dangers constantly before the notice of the student.

We have a power in the elasticity of a piece or ring of rubber that is perfectly under control, and of great value, but to render it safe it must be ligatured to the plate or to the teeth.

Springs made of pianoforte wire are now extensively used for moving teeth. They may be of the simple form as shown in Fig. 44, which are bent so as to spring against the mis-

Fig. 44.

placed tooth, or they may have a coil so as to increase their springiness.

These springs are practically modifications of the Talbot spring (Fig. 13), one end being cut short at the coil and fixed in the vulcanite plate, while the free end is bent so that it will act against the offending tooth. A little screw post should keep the coil in position and prevent displacement. In ordinary cases the free end of the spring may simply press

against the neck of the tooth, but where one has a strong canine to press outwards, the spring may be so bent that it presses slightly under the gum, and so gets a greater leverage on the tooth.

Besides the manifold cases of Dental Irregularities that yield to one form or other of Mechanical treatment, we sometimes find ourselves face to face with such an abnormal condition of the Dental Arches and teeth that even the most ambiti-

Fig. 45.

ous among our number would shrink from undertaking on the ordinary lines, the chances of even a partial success being too remote to justify a long course of treatment by one or other of the methods usually adopted. It is to two or three of these cases, that attention is now directed.

The first is that of a girl about nineteen, who was brought under my notice by my friend Dr. Percy Jakins, who had been treating her for some throat mischief, deafness, indigestion and various ills arising in a measure it might be assumed

from the terrible condition of her mouth. On looking at Fig. 45 it will be seen that the patient's mouth is partly open; she could not close it any more. The next condition is apparent by looking at Fig. 46, this shows the state of affairs in the mouth, all the teeth being practically functionless, and so far as one was able to judge could not be rendered otherwise by conservative treatment.

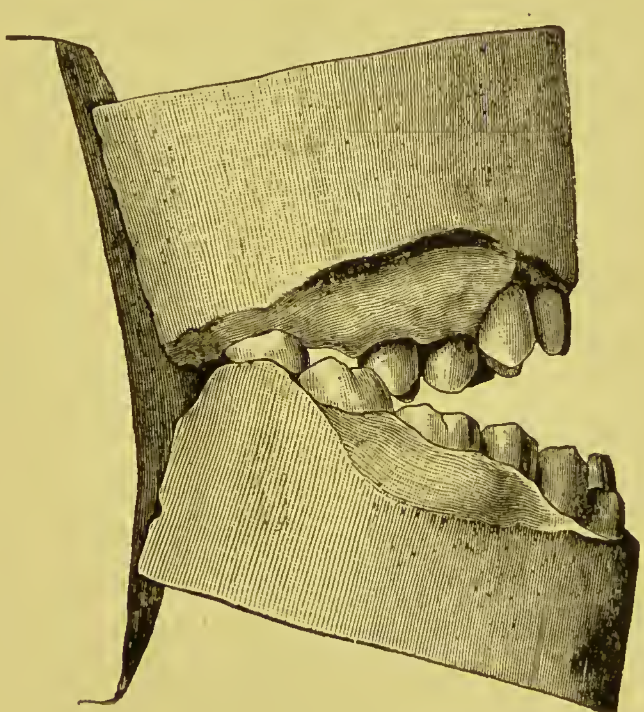


Fig. 46.

When dealing with these conditions of the teeth, one has to consider first, if when the teeth are extracted the patient would be able to wear artificial substitutes with comfort, and secondly, one has also when preparing the mouth to leave no loophole for failure, by being tempted to leave in the mouth teeth that might interfere with a successful result. It is only

natural that one should wish to preserve as many of the patient's teeth as possible, but at the same time if the denture that one has to construct is not a success, then the last condition of that patient is decidedly worse than the first.

In order to see if there was the least chance of utilising any of the teeth, the molars on each side were removed under gas, this had the effect of giving a little more play to the jaws, but the amount of approximation obtained was not sufficient to justify one in abstaining from the removal of the whole of her teeth, which operation was performed under gas and ether. In less than three weeks the patient was able to wear a temporary set, and masticate her food fairly well, and also to close her lips together comfortably as seen in Fig. 47.

Fig. 47.

At the end of six months permanent cases were made and she could then use her teeth well in every respect, and her health had considerably improved.

The next case (Fig. 48), is that of a girl about the same age as the last, it is a well marked case of underhung bite. I

am indebted to my colleague, Mr. Charles Glassington, for bringing this patient to my notice ; he consulted with me as to the probable success of a denture. It was thought at first

Fig. 48.

that a case could be made to cap over her upper teeth, and made to project sufficiently to bring the lower teeth into

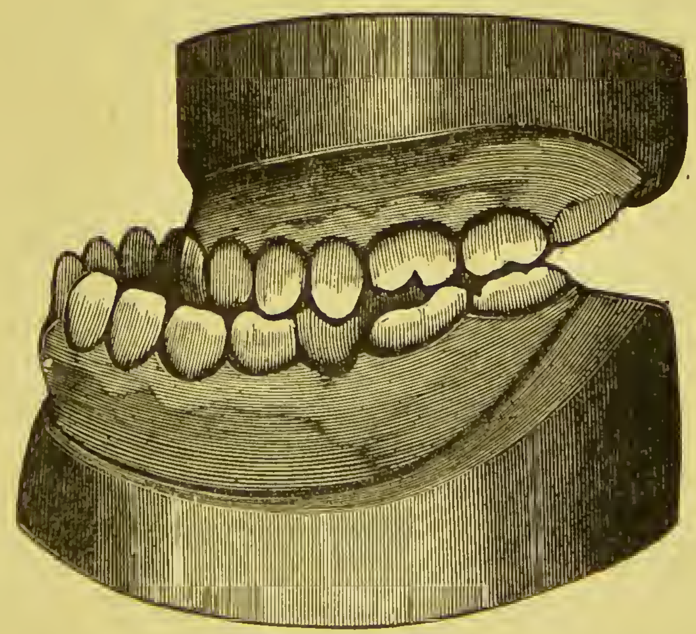


Fig. 49.

articulation, but the evil attending that mode of procedure would have been the rapid decay of the covered up teeth and consequent worry and discomfort to the patient.

On examining the patient's mouth (Fig. 49), and building

Fig. 50.

up a wax case to the upper, to give one an idea how the patient would look under the altered conditions, the result was very gratifying, and on raising the bite fully a quarter of an inch the appearance of the patient was improved still more.

It now became a question as to the retention of any of her upper teeth, and feeling convinced that an edentulous upper presented the best chances of success, in which opinion Mr. Glassington concurred, he removed her upper teeth and made her a complete upper case. Figs. 48 and Fig. 50 are

before and after the operation. One cannot but feel gratified that the results gained not only considerably improved the

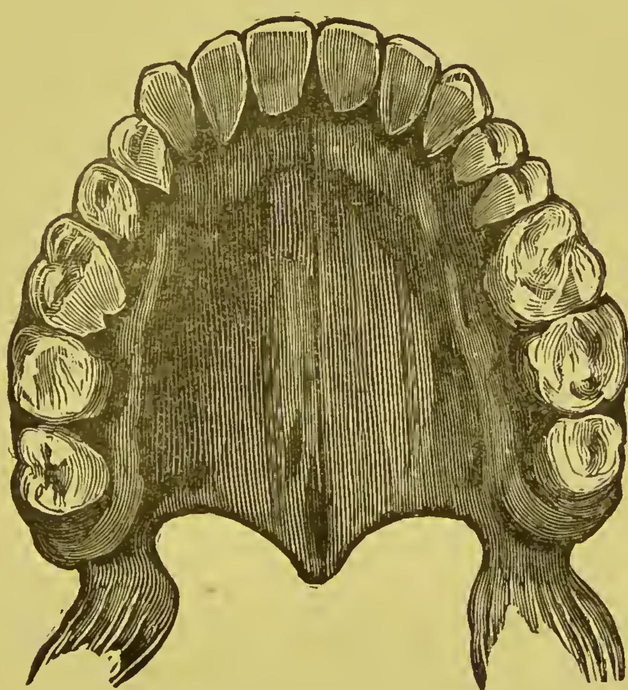


Fig. 51.

looks of the patient, but at the same time put her in possession of a useful dental armature instead of her own functionless ones.

The only other case (open bite) in which I had to resort to such extreme measures was one in private practice. In this latter I was able to retain the patient's lower front teeth, and make up the depth of the upper case in continuous gum. The appearance of the patient in this case was also much improved, as well as her general health.

As a contrast to these abnormalities, and also to serve as a

Fig. 52.

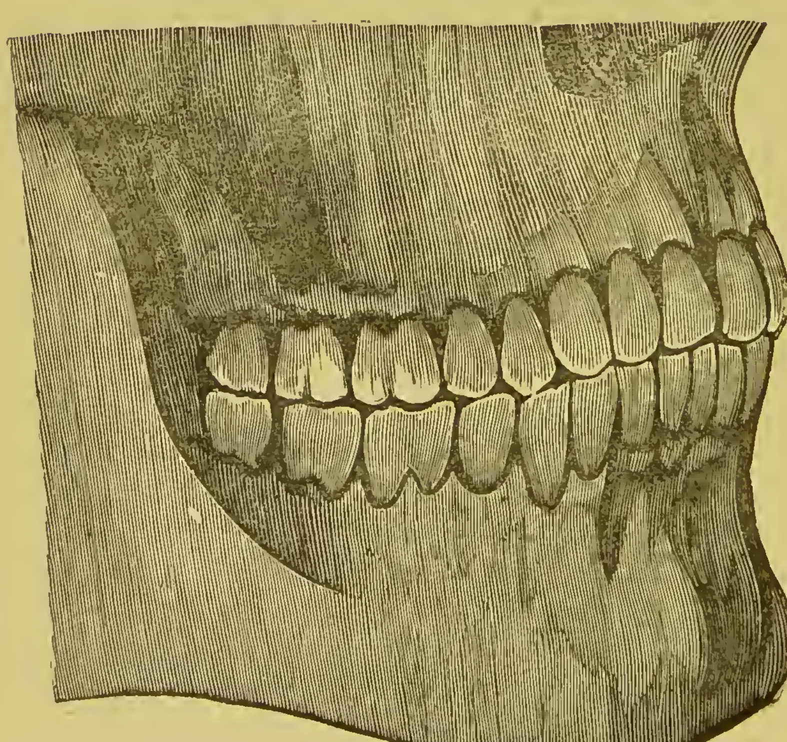


Fig. 53.

guide to those who in setting up teeth aim at reproducing a perfect arch, I have here introduced specimens of typical dental arches. Figs. 51 and 52 show the arrangement of the teeth in an early Saxon skull. The teeth are somewhat worn, but not the slightest trace of decay is visible in the whole thirty-two teeth. The width across the palate of the upper and between the wisdom teeth in the mandible gives ample room for the teeth without crowding. Fig. 53 shows the articulation of the same jaws, and gives one a good idea as to what a perfect dental armature means. A similar skull to this, dug up at the same spot, is now, I believe, in the Fitzwilliam Museum at Cambridge, with a broken spear-head imbedded in it.

DENTAL MECHANICS.

PART V.

Continuous Gum Work and Porcelain Crowns.

BY

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WITH NUMEROUS ORIGINAL ILLUSTRATIONS.

London:

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DENTAL MECHANICS.

Part V.

CONTINUOUS GUM WORK AND PORCELAIN CROWNS.

When one considers the immense improvements that have taken place in the manufacture of mineral teeth during the last thirty years, both in the quality of the materials employed, their natural appearance, shape and colour, one might almost imagine that further progress was impossible. And when in addition to these, one is presented with teeth having porcelain gums attached, (known as "gum sections"), one might be tempted to say that nothing more was requisite for dental prosthesis.

Such, however, is not the case. Our art is progressive, and the true conception of it shews above all, that it is necessary for the dentist to be an artist, to manipulate in such a manner these dental substitutes, that Nature's offices may be efficiently performed, and the restoration of the patient's features so perfected that the observer is deceived.

Ordinary pin or vulcanite single teeth without gums can be so mounted as to reproduce the contour and lost expression of the features, and each tooth arranged to preserve its own individuality; this latter is a decided advantage, but having to mount these teeth on a rubber base detracts very much from the artistic appearance of the work, although not from its strength or usefulness.

With Gum Section teeth the advantages are, that the porcelain gum takes the place of the rubber, and so produces a more natural appearance, but at the same time the blocks themselves give a stiffness to the work that renders it impossible to produce the same expression as can be brought about by using single teeth.

Again, the joints between the blocks are not always invisible, nor can a perfect freedom from cracks in the blocks be foretold with certainty.

But in my opinion the principle fault in gum sections lies in the fact that it is next to impossible to get them to conform to the contour of the alveolar ridges with any degree of precision, unless one has an immense number to select from.

Here Continuous Gum Work steps in and enables the true artist to perfect his ideal, and follow Nature so closely in all her delicate symmetry of form and colour that the human eye is charmed, and at the same time deceived.

This work is acknowledged to be the most beautiful and artistic of all the creations of prosthetic Dentistry, copying in the best efforts Nature so truly and faithfully, not only by the naturalness of its colour for gums and teeth, but by its adaptability for reproducing the contour of the Dental Arches, and for the ease by which individuality is given to every tooth, and its proper expression restored.

These valuable qualities carefully brought out by the experienced ceramic artist render it impossible for anyone professional or otherwise, to say that a patient has other than his own natural teeth.

To the great majority of dentists the history of Continuous Gum Work has been one long course of disappointment and failure.

Energetic and enterprising members of our profession have taken to it repeatedly, and after each essay, have had to give it up after the loss of much time, trouble and expense. Why is this? Continuous Gum Work came into use in America about the year 1850, and during the last forty-eight years, the number of those practising this work might be counted on one's fingers, and the number of those excelling in it would be reduced still less. If wrong in this statement, I am open to correction, but as far as regards our own country, this work has been a decided failure.

This statement is worthy of the most serious consideration.

While endeavouring to show the cause of these failures in the past, I will point out to those who still have the courage to proceed, a method by which they can obtain the best results, and avoid the pitfalls of the older systems.

By the older systems, one means those in which one has to solder the teeth to the plate, and introduce the case three or four times, unprotected, to the risks of the furnace.

As an ardent votary of this work for upwards of eight and twenty years one may perhaps be pardoned for speaking egotistically, but one feels somewhat justified in so doing when the results obtained by the system advocated go so far towards substantiating the statements to be set forth.

One might perhaps draw the attention of the reader to a

somewhat practical illustration by stating that during twenty years the cases undertaken were few and far between, but during the last eight years they have numbered close on two hundred.

These cases consisted of complete sets, partial dentures, and gum facings, and they go far to prove that with the simplifying of the process much more work was undertaken, and much more could have been done than would have been the case otherwise. At present it is in such general use in the laboratory that one takes scarcely more notice of a continuous gum than of a vulcanite denture.

At a meeting of the British Dental Association, held in London in 1890, the privilege was accorded me of demonstrating to its members what I then considered an important departure from the old method of making continuous gum dentures, inasmuch as it did away with all the *risk* entailed in soldering teeth to the plate, and, as a rule, only required one *firing* in the *furnace unprotected.*

It was also shown that special teeth were not required ; any maker's tooth could be used, in fact, any kind of tooth—tubes, "flats," or vulcanite, teeth with pins and teeth without, the only qualification necessary in the tooth was that it should be of a higher fusing point than the mineral compound or "body" used. To make this clear to the reader, I might mention that after baking, the attachment of the teeth to the body renders the case one solid and homogeneous block, and lastly, that only one firing for baking the mineral compound and one for fusing the gum enamel was necessary.

To account for my giving this demonstration, I might mention that after some twenty years experimentalising I found myself in possession of a Body, which I designate

"Mineral Compound," that is uncrackable and practically unshrinkable, and when fused retains its shape in a very remarkable manner.

Recognising this important fact it suddenly occurred to my mind that I could perhaps make a radical departure from the "old" system and instead of soldering the teeth to the platinum plate do away at once with the risks and vexations of this old form of work.

It will be noted that the method advocated is somewhat analogous to plate work with the teeth attached by means of vulcanite. Similar "tags" or fastenings of platinum wire are soldered to the plate for the attachment of the mineral compound.

The teeth, as in vulcanite work, are mounted in wax on the plate to try in the mouth, but instead of the waxed-up set being inserted in a gun-metal or other flask, plaster sections are made to hold the teeth in position.

After the sections are separated from the case the teeth are carefully removed and the plate cleaned from wax. This, after roughening the surface, is placed on the model and the sections replaced in position. The teeth are inserted in their respective places a few at a time and mineral compound packed around them. Thus instead of using rubber its place is taken by the mineral body, and instead of vulcanizing one uses a small furnace to bake the case in.

This is roughly a description of the system which renders the making of a continuous gum denture nearly as simple as one in rubber.

Mentioning this discovery to a friend, he induced me to give a demonstration at the next meeting of the Association, the annual one, 1890,

That demonstration was given, although there were but six weeks in which to prepare the models and cases, and I can conscientiously state that after having stood the test of eight years' practical and, so to speak, every day work, the opinion then formed of the new method has been more than well founded, and the claims advanced in its favour have amply proved, as time went on, to be perfectly justified.

During this long period many demonstrations have been given and numbers of cases made for patients and others, and one has yet to see the case where any of the body or mineral compound has broken from the plate during mastication.

One looks upon rubber as a safe material by which to attach teeth to a plate, and one may also regard the mineral compound in the same light, for its adhesion to the plate (platinum) is such, that when properly manipulated, it requires to be made red hot, dipped into cold water, and then hammered before a parting can be effected.

Up to the period of introducing this system, like others of my professional brethren, I had been dabbling with Continuous Gum Work on the old lines, that is, by a preliminary fixing of the teeth to the platinum plate by means of a bar or backing of the same metal, to which they were soldered with fine gold.

The teeth employed were natural pattern, long rooted, American teeth, made for this purpose. This system and its various modifications has had its advocates who have tried it again and again, only to give it up as unprofitable and not worth the trouble, worry, and disappointment attending it. In the hands of specialists like the late Dr. John Allen, and two or three others, it could be made to answer, but I question very much, if the great Ceramic artist had known another

method by which the risk was reduced to a minimum, and the result certain, whether he would not have been the first to adopt it.

The ordinary dental practitioner is not a specialist, at any rate in the Ceramic art, nor can he afford to send his cases to one, although in the old days the advice in one of the earlier editions of Harris's "Principles and Practice of Dentistry," was perhaps the best and soundest that could be given. It was to the effect that the dentist should send his models and instructions over to America, and have the case made by one who had made this work his life-long study.

That advice is still the best to those who follow a system "that requires the work to go through the fire unprotected four or five times," they would save both time and money by adopting it.

So much has been written on the subject of Continuous Gum Work, that one would almost imagine that it ought to be as common in dental practice as an ordinary rubber denture. And so it ought to be, if the systems advocated were such as one might take up with some amount of confidence, as to the ultimate result. This however is not the case.

To such an extent have the difficulties and uncertainties of this work depressed the dentist, "who having been on previous occasions carried away in a fit of enthusiasm to try some new furnace or other, ultimately to come to the conclusion that the success attending his efforts was not of such a nature as to encourage him to proceed,"* that it is now extremely difficult to convince him that a system exists, by which he can treat and make Continuous Gum dentures with the same certainty as an ordinary rubber plate.

* These are the words of a man well known for his efforts in this direction.

The success of the system depends entirely upon one important factor, and one only, namely, the use of a porcelain or mineral body that possesses the property of being practically uncrackable and unshrinkable. Although not claiming a perfect immunity from the last-named (that being impossible), still in this material it is so perfectly under control, that it permits of a method of manipulation that has never to my knowledge, before been attempted with success.

This material has also the remarkable property of retaining any shape it is moulded into, unless considerably overbaked, and its adhesion to the teeth is perfect.

These properties render it extremely valuable in crown and other porcelain work, and distinguishes it from all others.

In order therefore that my readers may not hereafter meet with those vexations and disappointments that have fallen to the lot of their predecessors, I must ask them to remember this first important fact, as upon it will rest their success in the Ceramic art.

It should be distinctly understood that I do not condemn the practice of soldering teeth to the platinum plate *when necessary*, but this necessity only arises when the teeth have to be so ground that the pins nearly rest on the plate, thus making the mineral investment very thin and consequently weak.

In the course of this treatise it will be explained, how this soldering can be done, without the risks usually attending it.

We will next discuss the details of the processes necessary for the production of the whole, and partial, sets, of this interesting work, including gum facings.

Having obtained a satisfactory impression of the mouth, the model should be cast deep as if for a gold plate, then dried, and boiled out in stearine.

The exact size of the plate may now be carefully outlined on the model, and if it is found necessary to take the pressure from the ridge in the centre of the palate, a thin heart-shaped piece of tin or lead should be fixed in position for that purpose.

The posterior edge of the palate of the model may be slightly scraped in order to ensure a closer adaptation of the edge of the plate to the palate, and if the labial and buccal aspect of the alveolar ridges are not undercut, these may be slightly scraped also—of course only corresponding to the edges of the plate.

In order to obtain the bite or articulation, a very good plan is to swage up a gilding-metal or german-silver plate ; this gives one a strong base on which to build up the composition to take the articulation, and at the same time affords one an excellent idea as to the correctness of the model, the amount of suction one is likely to have, and the probable success of the case.

This in a continuous gum set is of vital importance, on account of the weight of the case, for if the adhesion of the plate to the palate is good, weight is of very little consequence, but if the mucous membrane is thin, dry and hard, then weight becomes a strong factor in displacement, and it is extremely valuable to ascertain this fact in advance, so that extra precaution may be exercised.

Having obtained the articulation and set up the models, we next swage the Platinum Plate ; this is recommended to be soft platinum, number six guage. It is a very easy

metal to swage, the only precaution being to keep it well annealed and to do all soldering with fine gold. With these plates, as with gold suction cases, I am content with the fit off the best zinc model, and usually try the plate in the mouth at this stage. If, as is generally the case, it fits perfectly, I trim the buccal aspects of the *plaster* MODEL where it usually binds to let it into place. This, I think, is upsetting some old-fashioned notions, but it only wants to be tried to realize its advantage. It has been explained before in Part 2, page 110, of this work, that although the plate may bind on the plaster model, it does not do so in the mouth, that it is due to the yielding nature of the mucous membrane, allowing for the slight contraction of the zinc model. Thus one gets a tight instead of a loose fit. After the plate has been trimmed to its proper size, take a length of platinum wire, say four inches, and draw down to half pivotting size, bending and adapting it a little at a time, and soldering it with fine gold until we have brought it round the buccal and labial edges of plate to the other tuberosity. The wire can be used thicker according to the requirements of the case; thus where the artificial gum has to be in small bulk and thin, then thinner wire can be used, but where a considerable amount of gum has to be built up, then we may thicken the edge in proportion.

The use of wire for thickening and strengthening the work is in the author's opinion much more satisfactory in its results than padding the model to turn up the edges of the platinum plate. In the first place, it makes a much neater job ; secondly, it admits of the plate being relieved, if necessary, without destroying the edge finish, and thirdly, it simplifies the swaging of the platinum plate and gives better results.

The roughening of the surfaces of the plate can be done with a triangular graver or the point of a sharp flat sculptor. It consists in raising little burs over its surface where covered by the mineral compound, and is a means of attachment for the same.

To form the loops or fastenings to still further hold the compound to the plate, holes are drilled, and wherever required, short lengths of soft platinum wire are soldered in

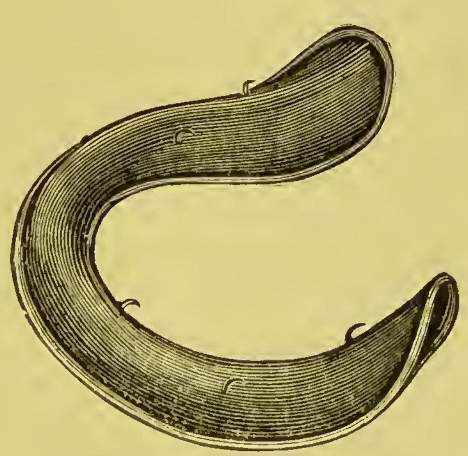


Fig. 1.—Lower plate showing a few tags of wire.

with fine gold. These pieces of wire or tags (Fig. 1) can be bent at different angles; eight or ten will usually be found sufficient for an upper or lower set.

The roughening of the plate should be done upon the zinc model or one might perhaps bend the plate. If this should take place it is very easily rectified by filling a small iron saucepan or ladle with casting sand and then driving the zinc model and plate into it; or if one has a Gartrell shot swager by using that for the purpose. Either of these methods will not interfere with the fastenings or attachments to the plate.

Having obtained the articulation one has now to mount the teeth on the plate with wax, and in this one may give effect to his artistic skill by arranging them in as natural a manner as possible.

When one takes into account that it is the reproduction of the waxed-up case that one aspires to produce in mineral, the necessity will at once be seen that great care and neatness should be exercised.

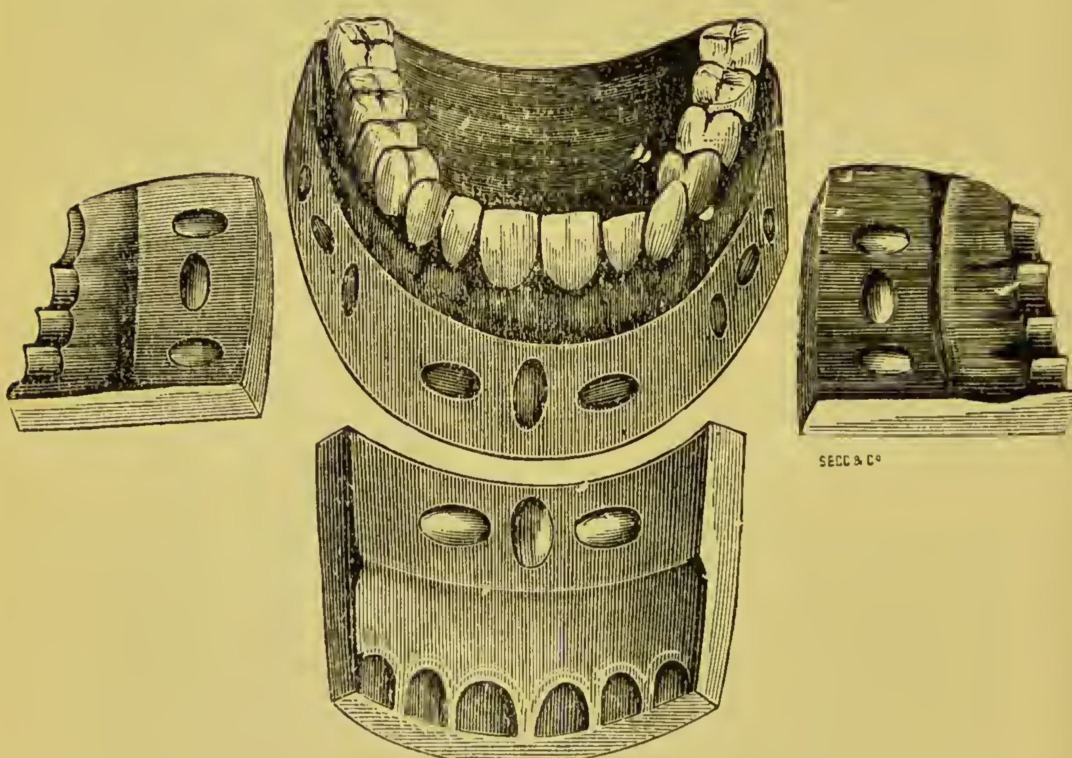


Fig. 2.
Shewing the case on the model, which is grooved to form guides for the sections.

It is as well to allow a slight space between each tooth, such as would be represented by a sheet of thick notepaper, and if the case is one where a pronounced irregularity is

aimed at then a little more latitude between them should be given. Without such spaces it will be found difficult to insert the teeth in the sections when packing in the mineral compound. There is no occasion for the teeth to fit the surface of the plate, it matters not whether they rest on the plate or have a layer of body under them.

Having mounted the teeth, the case may be tried in the mouth and any alteration effected.

The next process is to make the plaster sections. On examining fig. 2 it will be seen that the case is on the model and the latter is grooved both in front and at the sides. These grooves are for the better adjustment of the sections and to hold the various parts together. The method of making the sections is as follows : after fixing the case in position the model is painted with a solution of soap, and then sufficient plaster of Paris is mixed to cover the front of the model, corresponding to the six front teeth, the plaster should be about half an inch thick and extend to the distal extremity of the canines; the side of the section should be made as upright as possible, and leave about the 32nd of an inch of the points of the teeth exposed.

When the front section is completed and the edges are bevelled so that the side sections will part readily from it, these latter may both be moulded or built up at the same time ; of course soaping the sides of the front piece and model as before. When these side pieces are hardened and trimmed up to correspond to the front, another called the crown section is made by pouring plaster of Paris over the crowns of the teeth. This is strengthened by having a piece of thick iron wire previously bent to the required form sunk in it. This section is shown in Fig. 3.

These sections, which take about an hour to make, constitute about the only hard work there is to do.

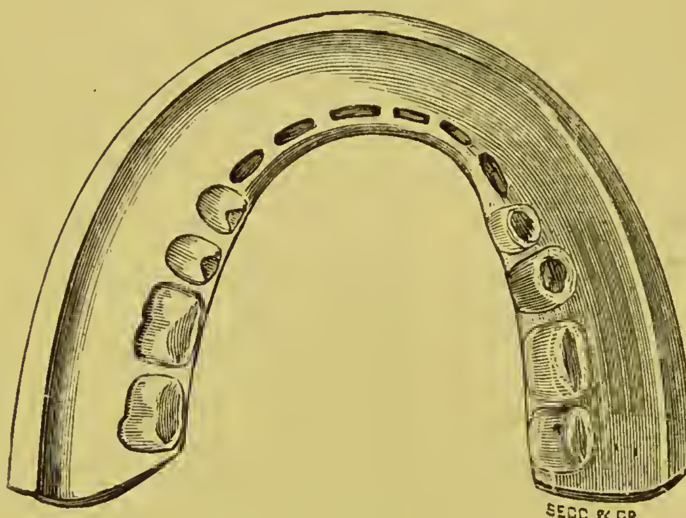


Fig. 3.

Having completed the moulding of the sections they should now be separated. It is very necessary to see that they part from the model and teeth quite easily. Should they require any force to remove them they should be trimmed where any dragging takes place, for if they presented any undercuts the fragile mineral compound would most probably be broken away on removing them.

We next have to remove and clean the teeth and plate from wax by pouring boiling water over them, after which the plate should be boiled in dilute sulphuric acid.

On no account should the wax be boiled off with the sections in position.

Our next business is to line the sections with tissue paper, this is effected in the following manner :—

The portion of the sections corresponding to the gums and teeth is painted with vaseline, the object of which is to prevent the too rapid absorption of moisture from the mineral compound, and also to prevent any adhesion of the same to the sections; it also helps to hold the tissue paper in its place. Small pieces of tissue paper are now cut out with a pair of scissors, so that they approximate to the size required, that is,

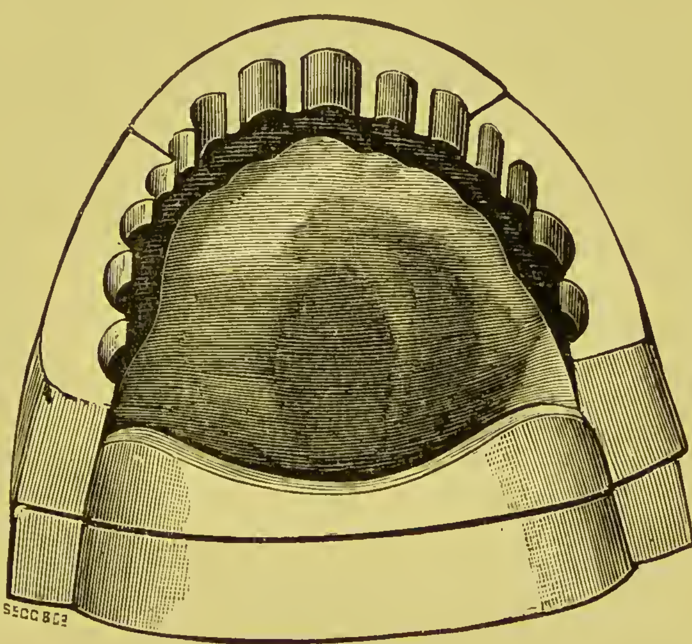


Fig. 4.

The fastenings on the plate are not shewn in the drawing.

they should quite cover the concavity in the sections corresponding to the gums and teeth. The pieces of paper are taken one at a time with a pair of tweezers and dipped into a little distilled water, then carefully placed in position on the vaseline surface, and pressed into place with a soft

bushy camel hair pencil. This closely adapts it without tearing to the surface of the section to which it adheres.

The only precaution to be observed in lining the sections, is to see that the paper does not extend above the points of the teeth, as it would prevent the crown section from going quite home.

Having now lined the sections, which operation takes about ten minutes, we take the plate and paint over it a thin coating of Gum Enamel, this is dried by slightly warming the plate over a Bunsen burner.

It should now be placed on the model, and the three sections are adjusted to the same and held in position with an India rubber band.

The sections will now present the appearance as shown in Fig. 4.

The teeth should now be arranged in a half circle on the bench in their relative positions so as to be able to replace them readily in the sections.

We now require a plate-glass slab about six inches square, and one-eighth thick, on which to mix the mineral compound; this can be obtained of any glass-cutter for a small sum.

A spatula for mixing can be made out of the handle of an old tooth-brush filed thin.

The mineral compound should be mixed with distilled water, and a small quantity of dissolved Gum Tragacanth; this latter hardens the material when dry, thus rendering it firmer to handle, easier to trim up, and less liable to fracture.

The method for preparing the Gum Tragacanth is to dissolve about 3 dwts. in a half-pint of boiling water. A convenient vessel for the purpose is a gallipot or similar jar,

which can be placed in an oven or over a Bunsen burner for an hour or two. The thick jelly-like liquid may then be placed in a wide-mouth bottle, and it is ready for use.

We next mix some mineral compound quite soft, and carefully introduce it by means of a blunt-ended spatula into the space formerly occupied by the wax, filling in, to start with, that portion corresponding to the molars and bicuspids on the right side. It should be filled in until it is level with the necks of those four teeth. The four teeth should now be placed in their respective situations, and the crown section placed in position; this enables us to press the teeth into their proper places, and in order to keep them there and to consolidate, more mineral compound firmer in consistency should be pressed under and against them, finally using some compound quite dry to still further harden the mass.

We are now enabled to remove the crown section, and proceed to place the opposite fonr teeth in position in the same manner as before; when this is effected the crown section is kept in place while the six front teeth are introduced and the material packed around them the same as the side ones.

In order to cover the palate, it should be painted first with a thin layer of gum enamel and then allowed to dry. Some mineral compound is mixed thin and then painted in an even layer over the gum enamel; this is also allowed to dry, when further additions of compound to form rugæ, &c. can be painted on. It may then be placed on one side to dry; an hour will generally be found sufficient.

The sections may now be removed. The object of lining the sections with tissue paper will now be apparent, for it enables the sections to part from the mineral compound quite

readily, and painting the sections with vaseline helps to hold the tissue paper in position, and prevents the too rapid evaporation of moisture from the compound during the operation of packing in.

Packing in the mineral compound or body usually occupies from twenty minutes to half-an-hour. It must be understood that the plaster sections are made for the sole purpose of retaining the teeth in position while the mineral body is being consolidated around them, and that to attempt to build the case up without these adjuncts, would result in a signal failure and waste of time.

Having removed the crown section one is able to ascertain if the compound is hard enough, and if that is satisfactory, then we may begin by removing one of the side sections, followed by that of the other side, and lastly by the front.

It will sometimes be found that a little surplus tissue paper is lapped over the sides of this section, if so, it should be parted from it with the blade of a knife, before attempting to remove the section from the model and teeth.

When the sections are removed and the tissue paper peeled off, we have to trim up and make good any defects in the front gum ; this is just as simple, if not more so, as build ing up wax for a vulcanite denture.

Artistic touches may now be given the gums, or additions in mineral made to them. Any error in the position of a tooth may also be rectified, by slightly moistening the compound and moving the tooth if found necessary. When this has been done, the case is ready for the first firing. Up to this stage it will be seen that the teeth have not been subjected to the slightest risk, and it will also be perceived later on that the first firing is also perfectly free from risk.

The method of preparing the case for the first firing is as follows:—

A fireclay or nickel pot about the size of an ordinary set box, but with slightly deeper sides, is partially filled with powdered silex (rock crystal) and the case is gently pressed into it, the teeth being uppermost. A further quantity of silex is now poured around the case until it is completely buried.

We now take three pieces of clean tobacco pipe stem about an inch long, and cover one end of each with a fairly thick layer of mineral compound ; when these are dry they should be inserted in the crystal around the case in the pot, the ends being left standing out to admit of easy withdrawal. These are the test pieces and can be withdrawn one at a time.

The object of sinking them in the silex is that they shall be under the same conditions as the case.

Whatever furnace is used for the firing, it is as well to ascertain by a preliminary test if the heat is sufficiently high This can be done by introducing into the muffle on a small fireclay tray a similar piece of pipe stem to those inserted in the pot containing the case, when this becomes fused, the pot containing the case, which should have been warming up, can be gradually inserted into the furnace.

The mineral compound usually takes about eight minutes to bake, but it is as well just before the expiration of that time, especially if a coke furnace is used, to draw the pot to the front of the muffle, take out one of the test pieces, and then push the pot back again into the muffle.

We now try the mineral compound on the test piece, by attempting to cut or scratch it with a knife or an old file, if we can do so it is not quite done and another test is with-

drawn as before ; if this latter cannot be cut and is found to be hard and strong, it is done enough, and the pot can be removed from the muffle and placed on one side to cool down.

As the silex covering the case effectually prevents any changes of temperature from affecting it, there is no object in placing it in an oven to cool.

The case might, if found necessary, be put through the fire at this stage, any number of times without the slightest risk of cracking a tooth.

One would perhaps imagine that by embedding the case completely in powdered silex it would when at a red heat adhere to the teeth and destroy their surfaces, which however is not the case, at any rate with such teeth as are made by the Messrs Ash, the Dental Manufacturing Co., and the principal American makers ; it simply acts as a safe investment and a protection. The silex also perfectly supports the case, and prevents warpage.

It is most effective also in preventing the thin layer of mineral compound leaving the plate where one has to bring it over the palate. This is very apt to shrink away unless kept down by the weight of the silex until properly fused.

Again, when one has to make a case with removable teeth, filling the sockets in the mineral compound with silex will prevent them losing their size or sharpness.

Let us now return to our case which is cooling down ; when quite cold it may be removed from the pot and the silex brushed from it. On examining the case, should we find a few flaws in it these should be carefully filled in with some mineral compound, first running a drop of water into the fissures to insure the compound running well in.

When this has been done, the case, without any further firing, is ready for the gum enamel. This treatment is all that is necessary in the majority of cases; exceptions may however be found where the mineral compound has to be extremely thin on the labial aspect or front of the case, or where the palate has to be very thinly covered. In such cases a second firing may be necessary, but not quite so much as the first, and of course under the same conditions.

When one reasons this matter out, one cannot fail to perceive that if such a small amount of shrinkage takes place in the great body of material forming the case, the further amount of shrinkage in the material with which the fissure or flaws are filled in with is practically nil, and is completely lost when covered by the gum enamel.

On no account should flaws be filled in with gum enamel. However perfectly they may be filled in with that material, a dark outline will always be present to show where the fissure has been.

Painting on the Gum Enamel.

This should be done with a camel's hair pencil a little at a time, painting on the first layer thin and then adding more until it is about the thickness of a threepenny piece over the work.

The gum should be carefully worked in with a penknife between the teeth, and when dry trimmed from around the same, so as to leave a sharp line of demarkation between the gum and the necks of the teeth; this gives them a much more natural appearance than by allowing the gum to blend or fuse on to the teeth.

Having now covered the case with the gum enamel, which

by the way, has to be mixed with distilled water only, it is quite ready for what I designate as the second firing.

This the last firing is the only one in which the slightest care has to be exercised, or where the smallest risk is run of a tooth getting cracked.

The firing is effected in a similar pot to that required for the first firing, the case being placed inside, but with no crystal around it.

For support two or three small pieces of broken fireclay may be placed under the ends of plate to steady it, but on no account must anything touch against the gum enamel, or else it will stick to it when fused.

It may now be placed on the top of the furnace to warm up. While this is taking place we procure a piece of clean pipe stem sufficiently long to rest lengthwise along the pot. This is painted in the middle with a fairly thick layer of gum enamel, and then placed on the top of the furnace to warm up.

To test and ascertain the heat of the furnace, a little gum enamel may be fused, before inserting the case, on a piece of pipe stem, this is a much better plan than judging the heat by guess work, in the first place one is absolutely certain of the temperature, and can limit the time the case is in the muffle.

After this heat test has been applied, the pot containing the case may be cautiously inserted in the muffle and the pipe stem with gum enamel on it placed across the pot in such a position that the gum enamel is just above the case.

Three minutes is about the usual time the enamel takes to fuse, and this can be confirmed by removing the pipe stem and seeing the condition of the enamel on it.

It is better to let the case remain in the muffle for a minute after the test is removed and is found to be well glazed, in order to allow for the extra bulk of material.

The pot containing the case should now be withdrawn and placed in a small iron oven made for this purpose, or it may be placed on a stone slab, on which some dry sand has been spread, and then covered up with a large crucible until it is quite cold. Care should be taken to exclude all draught from the case when cooling down. The edges of the case may be smoothed with a fine carborundum wheel and finished with water of Ayr stone.

To give the case an extra finish and perhaps a more pleasing appearance, it may be heavily gilt, by having fire gold deposited on it. This, however, should not be done until the case has been worn a short time, and one finds that it does not require further relief.

The truly artistic mind can scarcely bring itself to associate continuous gum with vulcanite. From such a standpoint it is like mounting a diamond in a setting of lead; yet in order to overcome one of the chief objections to this work, viz., weight, recourse may be had to what is known as Continuous gum facing.

A gum facing in conjunction with a rubber base possesses certain advantages; one obtains first, the accurate fit of the vulcanite denture; second, the artistic appearance of continuous gum; and lastly, a considerable diminution in the weight of the case.

On the other hand, to repair such a case, if the fracture damages the porcelain gum, is very difficult, if not an impossibility, so it behoves one in manufacturing these facings to make them in such a manner, that should a fracture occur

while wearing it, it shall be limited to such an extent as only to involve a tooth. In vulcanite work when a tooth is fractured it usually breaks across the pins; this constitutes its weakest point. Now, if in making the gum facing, we leave the pins of the teeth free, so that they can be held in

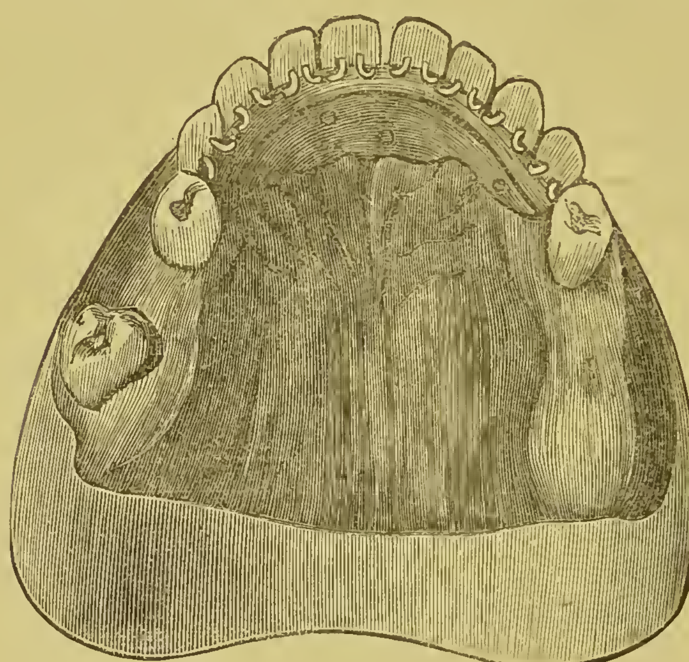


Fig. 5.

the vulcanite, my experience is that the tooth gets fractured in the same manner, if at all, as it does in a rubber denture and the gum of the facing is not damaged.

The object of this chapter will therefore be to point out how a gum facing can be so constructed that a bad fracture, that is one involving the gum, will be of rare occurrence, and an ordinary fracture, that is one involving the tooth only, can be as readily repaired as a rubber denture.

Fig. 5 is a fair example of a gum facing of eight teeth, which will serve us as an illustration to show the method of making.

Our first consideration is the plate. This should be of No. 5 soft platinum, and extend as a support to every part of the gum surface. It should also be so cut out, that it will be considerably broader in the centre than at the extremities, (see Fig. 6),—this strengthens it very considerably, and prevents warpage. If the plate, owing to the closeness of the bite, has to fit directly on to the model, the surface may be roughened with a graver or the sharp edge of a flat

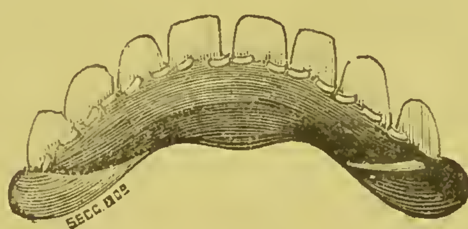


Fig. 6.

sculptor after swaging, and tags of platinum soldered to it with fine gold ; these should be placed wherever there is sufficient thickness of material to allow of it. On the other hand, if there is room for a thin layer of vulcanite under the plate, perforated platinum can be used,—this still further lessens the weight of the case. The edge of the plate may be turned up by padding the plaster model prior to casting, or preferably, soft platinum wire may be soldered along the anterior border. This gives a finish to the plate, and allows of a certain amount of easement without spoiling the edge.

After stamping up the plate, the next thing is to mount the teeth, taking the same precaution as to placement as previously mentioned for a full denture. When this has been effected, the waxed up piece may be tried in the mouth, and any alteration made that may be deemed necessary.

E

After this final adjustment, our next care is to place the case on the model, and make the plaster sections as previously described, to keep the teeth in position.

In this particular piece two front sections and a crown piece are only necessary, there being but eight teeth on the case.

Afrer making the sections and separating them from the case, the teeth are removed from the plate, which is then made red hot and placed in sulphuric acid to clean it, while boiling water is poured on the teeth to free them from wax, etc.

Presuming the surface of the plate has been roughened and the tags soldered on, it should now be painted over with a thin layer of GUM ENAMEL ; if the plate is slightly warmed over a Bunsen burner the enamel will dry almost as soon as it is put on.

We next place the plate on the model, and after adjusting tissue paper to the two front sections they are placed in position and held there by an India rubber band.

At this stage of the work I might remark that the facing may either be made with the teeth removable or otherwise.

If the teeth are to be removable it will be necessary before adjusting them to the sections and packing in the mineral compound to paint their necks with vaseline ; the packing in of the mineral compound being precisely the same as previously described for a full denture.

When the mineral compound is sufficiently hard the sections may be removed and the case trimmed up on its labial aspect ; this having been done, the sections should be replaced, and the mineral compound carefully removed from around the pins on the palatine aspect of the case (see Fig. 6).

We are now enabled by slight pressure outwards from its socket, to loosen and remove each tooth.

Should the edge of a socket get chipped when removing a tooth, it may be very readily made good again by lubricating the neck of the tooth, replacing it in the socket, then damping the margin with a little water and making good the defect by adding a little more compound. When set, the tooth may be removed again.

It will now be perceived (by referring to Fig. 7) that we have the platinum plate covered with the mineral compound which forms sockets for the reception of the teeth.

This plate, minus the teeth, has now to be fired.

Before, however, placing it in the fireclay or nickel pot previously mentioned, the sockets of the teeth in the mineral compound should be carefully filled in with extra fine ground silex (Rock Crystal); this will prevent the sockets from changing their shape. When they have been thus filled

Fig. 7.

in, the case may be completely embedded in silex, and the firing proceeded with. It is as well not to remove the silex from the sockets until after the second firing when the gum enamel has been fired, but any silex around the

extreme margin of the same should be removed, as it would not do for the gum enamel to come in contact with it.

If care has been exercised in the manipulative part, and the firing properly attended to, the teeth should scarcely require any fitting to replace them in position, and the case can be vulcanized in the same manner and with the same precautions as a gum section set.

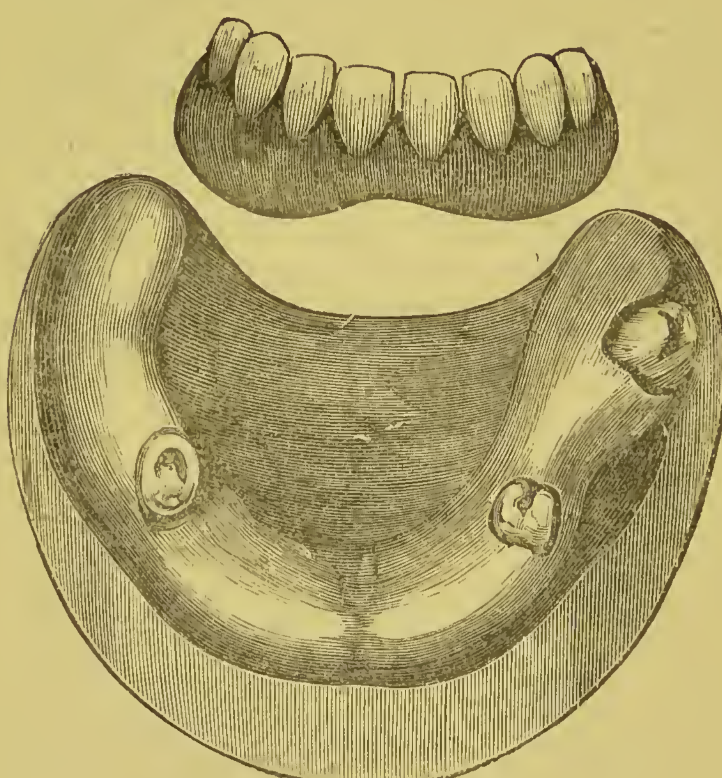


Fig. 8.

The making of gum facings with removable teeth is not new. In the year 1887, Mr. Cummings, of Glasgow, read a paper and demonstrated a method which was published in the Journal of the British Dental Association.

It consisted, roughly speaking, of a platinum plate struck

up to the necks of the teeth in such a manner as to restore the contour of the gum, as well as to form sockets for the teeth to rest in. The body covering the platinum plate was allowed to dip down into these sockets so as to form an accurate fit for the teeth, which were afterwards removed, when the body was hard and the moulding process completed, the case being fired without the teeth. In speaking of his ingenious process, Mr. Cummings said it is not one that can be successfully accomplished by a lad of a year's experience in a workroom, but at the same time any difficulties there may be can easily be overcome by a trained mechanical dentist.

In comparing the two processes it will be seen that I make the mineral compound alone form the sockets for the teeth, and this, owing to its freedom from alteration of shape during firing, enables me not only to dispense with a complicated plate, but simplifies the process to such an extent that any one can carry out the details after a few hours instruction.

If the teeth are not to be removable, the vaseline is omitted when the case is packed with mineral compound, which is then dried, and the sections removed. We now give the finishing touches to the front gum, then the sections are replaced, and the mineral compound carefully removed from around the pins of the teeth, this can conveniently be effected by a very small excavator. The object of this is to allow the rubber to get a hold of the pins and so lessen the risk of a bad fracture taking place at any time during wear.

Fig. 8 is the front aspect of the facing, while Fig. 9 is a smaller facing requiring only one plaster section to keep the teeth in position while packing in the compound.

Mineral Blocks.

One reads in the older works on Dental Mechanics a good deal about the beauties of Carved Block work, and from the few examples that I have seen there was good ground in some instances for extolling its natural appearance and artistic merit.

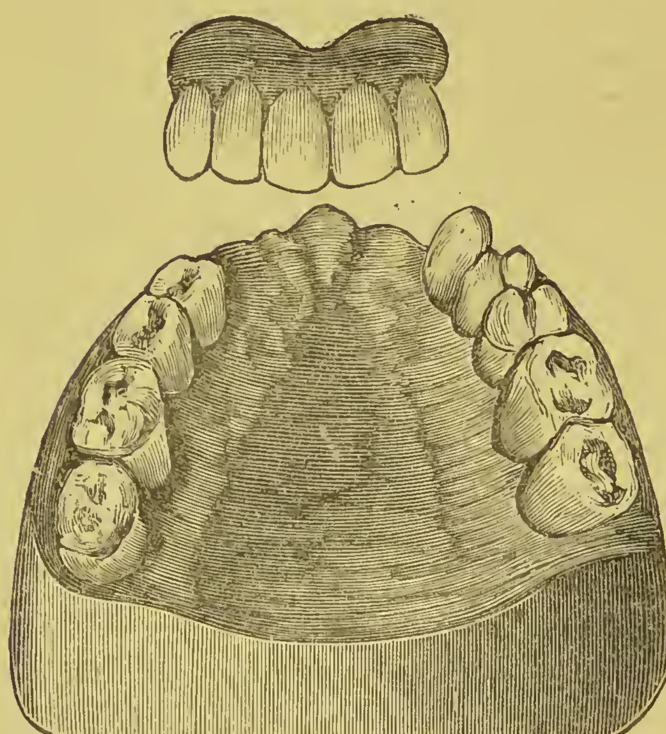


Fig. 9.

As works of Art these cases were worthy of being placed in a Museum and handed down to posterity as examples of what our forefathers were capable of doing, and as strong evidence of the skill of the dental artist who has gone before, but as far as regards utility, except for educational purposes, this work has long since departed from the dental repertoire.

In this age of progression when one has to cater for thousands in the place of hundreds formerly, it is impossible, or next door to it, to obtain adequate fees for work involving such risks as carved blocks, irrespective of the long and special training required before one was found competent to undertake it.

It required a special aptitude for carving, and a keen appreciation of the shapes, proportions, and symmetry of the teeth, giving to each its individuality and yet blending them in one harmonious whole.

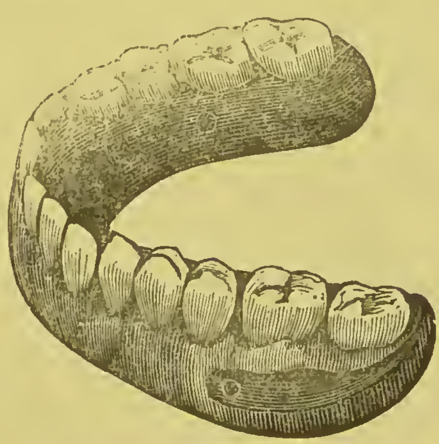


Fig. 10.

The age of Bone Work saw the advent of carved blocks, and this creation of the dentists' skill, like the carved mineral blocks, will in all probability be seen no more.

Having these facts in view, I am about to describe a class of work that quite equals, if it does not surpass in appearance, the finest carved block work that was ever produced, and which can be manufactured with equal certainty and freedom from risk as the Continuous Gum pieces, that have previously been brought before the reader.

I will call these cases Moulded Mineral Blocks. (Fig. 10). To manufacture these blocks, one should after taking the impression of the mouth, cast plaster into it so as to make a fairly deep model.

The next thing is to mount the teeth in wax, to enable one to try the case in the mouth, and care should be taken when mounting to have a slight interval between the teeth, say about the thickness of a sheet of notepaper.

After the case has been tried in and all defects remedied, the next care will be to make the three front sections in plaster, also a crown piece as already described. We now separate the sections from the model, and then remove the waxed-up case, and separate the teeth from it, and clean by pouring boiling water on them.

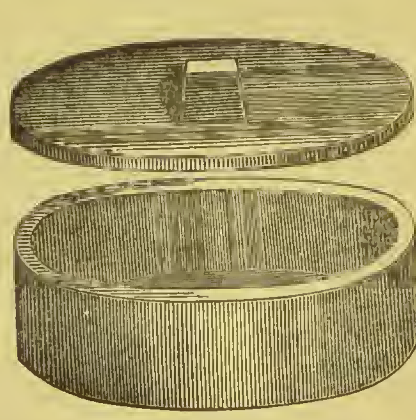


Fig. 11.

We now take the model and mould to its surface a thin piece of wax, corresponding to the thickness of the rubber required beneath the block.

The next process is to mould a sheet of thin tin foil over the wax. This is to prevent the mineral compound from sticking to the wax, and to make doubly sure that the mineral

compound shall part readily. The tin foil is painted with vaseline, and tissue paper, after being damped, is pressed on to and moulded to it. This constitutes the preparation of the model.

The first sections are now lined with tissue paper, then placed in position on the model and held in place by an India rubber band.

We are now ready to place the teeth in their respective places. Mineral compound in a fairly thin condition is first pressed with a suitable spatula into the space corresponding to the right molars and bicuspid region, until it is up to and level with the necks of the teeth, care being taken that the tissue paper is not abraded.

We next place the two molars and two bicuspids opposite their respective sockets, and then adjust the crown section, which enables us to press the teeth into their proper position, and hold them there until the moulding process is completed

When the teeth are pressed up against the crown section mineral compound mixed much thicker is pressed under and around them, finally using a little quite dry to consolidate and fix the teeth. We should now be able to remove the crown section, and proceed to arrange the four teeth on the opposite side. The crown section is kept in position while the six front teeth are fixed in their respective places and the mineral compound packed around them. Now is the time to place the strengthener in position. A very strong strengthener can be made by taking a piece of platinum wire corresponding in guage to that required for Ash's tube teeth, say two and a half inches in length, and bending in a half circle, so that it conforms somewhat to the backs of the teeth. A strip of No. 5 platinum plate about $\frac{1}{4}$ of an inch wide,

and the same length as the wire, is then bent in the same curve as the wire, to which it should be soldered with fine gold.

The wire should run along the centre of the strip of platinum. This strengthener is now embedded in the substance of the case and mineral compound pressed around, and also to cover it up, at the same time the full amount of mineral compound is added to the case so as to build up the necessary contour.

The moulded case may now be put on one side in a warm place to dry for an hour ; it is then usually hard enough to permit of the sections being removed, the case to be trimmed up and any addition made to it. While this is being done it is as well to keep it on the model, as at this stage it is in its most fragile condition.

After having received its artistic finish, it should be still further dried, and then placed on a bed of silex in the firing pot, (Fig. 11.) more silex being poured over it until completely embedded teeth and all. The lid represented in the diagram is for covering the pot up on removal from the muffle.

The next proceeding is to light the furnace, and while the heat is rising the case may be gradually warmed up, so that when a red heat is established the case may be introduced into the muffle. This, of course, applies to whatever form of furnace is used.

The case has now to go through the process known as biscuiting ; two or three minutes at a "cherry red" heat is quite sufficient for this purpose. When cold, the case may now be handled with a fair amount of safety, using the file and putting the final finish on the edges. A series of holes

Fig. 12.

should be drilled in the base of the case (see Fig. 12). These can be made very readily by using a rose bur on the Dental engine, and then an undercut is produced by an inverted cone. The holes are to serve for the retention of the rubber to the base of the block. When all the holes are drilled it is as well to fill them in with a little damp silex. The case is now replaced in the firing pot and covered up with silex as before. Test pieces should be placed in the pot and imbedded in the silex, as previously described, and the block baked until of a stony consistency ; this, of course, is easily ascertained by means of the three tests. If the heat in the furnace is of a bright red a test piece may be removed in about six minutes, and if not sufficiently done two minutes more should be given and the second test piece taken out. The third test piece is seldom required, but is placed more as an element of safety, in case one is tempted to remove a test too early.

It is not necessary to glaze the block, it should have a dull appearance like Parian ware. The pot should be taken from the furnace and cooled down.

If any flaws are present they should be carefully filled in with mineral compound, after which it is ready for the gum enamel, which should be painted on in as even a layer as possible, about the thickness of a sixpence.

The case is now ready for the last firing, which is in fact the only process involving any risks, the chief, of course, being the danger of draughts. The crystal in the holes in the base of the case should not be removed, but more placed in if required.

It is as well to place the piece in the firing pot with only a very thin layer of silex for it to rest on to steady it, as on no account must the silex touch the gum enamel.

The case should be carefully heated up on the top of the furnace and if the temperature is suitable the pot may be cautiously inserted into the muffle. When in position and getting red hot, the muffle should be closed and the case given three minutes.

The test in this case is a piece of clean pipe stem about four inches long with a little gum enamel painted round the centre of it, this should rest lengthwise on the edges of the pot, so that the gum test is immediately over the work.

This test can be easily removed for reference and replaced if found necessary. When the test is well glazed the case is finished and should be withdrawn and covered up to cool.

Fig. 13 is an instrument for removing the pot from the muffle.

Fig. 13.

This kind of work will suggest itself to the dentist whose

patient exhibits more than usual of the gums and teeth in the mandible.

In order to fix swivels to these cases when springs are required we proceed as follows :—

A groove for the spring is carefully made in the waxed up piece and then holes made corresponding to the position of the bolt of the swivels (see Fig. 10). These holes must completely perforate the wax. Into these holes small pieces of steel wire, say about 1½ inch long, are inserted, so that about 1 inch projects from the outer aspect of the case. The plaster sections should now be cast with the wires in position, (see

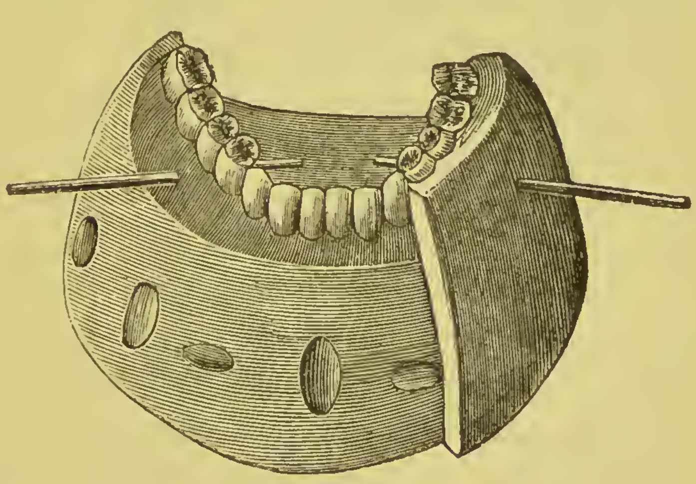


Fig. 14.

Fig. 14). These wires have to be withdrawn by pulling them through the side sections before the same can be removed from the waxed up case.

When the sections are lined with tissue paper, the steel pins are oiled, then pressed through the section and tissue paper so as to project about half an inch on the inside.

We now make a small platinum tube in the following

manner : Obtain a piece of a knitting needle the exact size of the swivel bolt ; take a strip of soft platinum foil, say No. 1, and after ascertaining the proper width, so that the edges shall slightly overlap on the needle, anneal and adjust it to the same. In order to make the edges quite close, draw the needle and tube once or twice through a draw plate.

The tube may now be soldered by using a little silver nitrate in powder, just damping so that it can be painted on the joint. The tube is then held in the flame of a Bunsen burner until the nitrate fuses into metallic silver. The platinum tube is now replaced on the needle and rubbed with a rough file, rolling it on the bench. It can now be cut to the required lengths by means of a sharp knife.

Two of these pieces of tube are removed from the needle and are placed in position on the pieces of wire that project on the inside of the side sections. These serve to hold the tubes in position when the teeth are inserted and the case packed with mineral compound in the usual way. When this has been accomplished and the mineral compound is sufficiently hard, the needles are first of all withdrawn and then the sections are removed, when we shall find the platinum tube occupying its proper position for the reception of the swivel bolt when the case has been fired and finished.

The possibilities of this form of work, especially for lower cases, is very great, the dentist being amply repaid for all his skill by the beautiful and artistic result produced.

It must, of course, be understood that these cases must be of a sufficient substance for strength, otherwise a platinum base plate is indicated.

There is yet one more direction in which this description

of work can be utilized, and that is in the manufacture of blocks or sections to be mounted on a gold plate, and to take the place of tube teeth, or to be used in conjunction with vulcanite, like ordinary gum section teeth.

The advantages one derives from making these blocks is that they can be adapted to conform to the alveolar ridges, individuality is given to the teeth, and with the aid of a small electric furnace no difficulty need be apprehended in firing them.

It is also quite possible in their manufacture to dispense with the use of platinum altogether, both in the teeth used, and also in the method of fixing them either on a plate or a vulcanite denture. This in view of the great rise in the price of platinum, may become of extreme value and importance.

I will now endeavour to place before my readers as clear an explanation as I am able of the process for making these blocks.

The teeth having been selected for the case, they should be mounted in wax, either on a gold plate, if that is to be used or on a matrix plate of composition, tin, or a swaged meter metal plate, in fact any material that is sufficiently rigid to allow of its being tried in the mouth to ascertain if any alteration is required in the placement of the teeth. This preliminary having been ascertained, the waxed case is placed on the model and a plaster section adapted to the six front teeth which are to constitute the first block.

The side sections are next made to take the molars and bicuspids. We now make two small crown sections to cover the crowns of the molars and bicuspids only. These side sections having been completed, are next removed from the model leaving the front section only in position.

The front section is now removed, lubricated with vaseline, and tissue paper adapted to it.

The plate on the model is next cleared of teeth and wax, rubbed with vaseline, and covered with tissue paper. The front section is now adapted to the model, and the teeth, after being thoroughly cleaned are ready to be inserted in their respective places.

It is as well to mould the front block first, and the teeth should be hollowed out at the back to allow of as big a bulk of material (Mineral Compound) as possible, and also to permit of the recesses being made in the base of the block for the purposes of fastenings.

The adjustment of the teeth and packing in of the compound has been already described. It must be understood that the front six teeth forming the block should be dried and fired first.

After the block has been moulded, dried, and removed from the plate or model, recesses or cavities may be made in the base of it, with a bur on the engine, and dovetailed by means of an inverted cone. If the block be too fragile, it should be biscuited, that is, made red hot in the furnace for a minute or two, when it may be handled without risk. We now place the block in silex as previously described, and insert carefully in the furnace and fire until quite hard.

When cold the distal extremities of the block are ground and bevelled the same as for gum sections, and are then rubbed with a little vaseline, a small piece of tissue paper being adjusted to them. The front block is once more placed on the model and the section for that, as well as for the two side blocks, adjusted to the model. These latter must of

course be lined with tissue paper the same as the front block section.

We now place the molars and bicuspids in position, and pack in the mineral compound ; when dry they are separated from the model and the front block, and fired, recesses being made in the base of each for the retention of the vulcanite, or to allow of stays being soldered to the gold plate, thus enabling one to fasten on the block to the plate with Harvard cement.

The blocks should be neatly adjusted to each other before they have the coating of gum enamel painted on.

If it is thought desirable to insert platinum tubes in these blocks, to mount on a gold plate, instead of the recesses before mentioned, parallel holes should be made in the wax with a broach when the teeth are being mounted, and if necessary, grooves cut in the teeth to accommodate them, in these holes small pieces of steel wire are inserted, so that the ends project. When the crown section is cast, these wires perforate it and serve to hold the tubes in position when the block is being moulded. When the latter is dry and hard, they are withdrawn one at a time thus leaving the tubes *in situ.*

The blocks are now placed in silex and fired in the usual manner.

By comparing the method adopted for the mounting of swivels in a continuous gum denture, it will be seen that the difference consists only in the position of the wires to retain the tubes.

Porcelain Crowns.

The first step in the manufacture of a porcelain crown is

the making of the band to fit the root, this may be made of No. 5 soft platinum, the edges slightly overlapping and soldered with fine gold. To solder, the edges may be held together with a small iron clamp, or bound round with a strand of iron binding wire.

In order to insure the gold flowing only on the joint, it is as well to paint the band with whiting, leaving exposed only that part where the gold is to flow. By this simple precaution we make certain of the gold running only where intended.

We have now to make a cap or covering for the root; if we take a small piece of paper and press it against the edges of the band, it will make a mark on the paper which will indicate the exact size of the piece of platinum that will fit inside the band and on to the root. After cutting this out, it is fitted inside the band and resting on the surface of the root. The two are now cemented together with a little hard wax and removed from the root.

We now mix up a little investment of brickdust, or pumice and plaster, and fill in carefully the under surface of the collar to prevent any gold running through while soldering, as such would prevent it from going home on the root. The whole is now carefully heated up and soldered with fine gold.

The same treatment may be adopted in soldering as with the band, that is to cover all the centre of the cap with whitening, leaving the edges clean, the gold then flushes nicely round it.

The next process is to roughen the exposed parts of the collar. To do this neatly it should be filled in with some soft composition, which is allowed to harden. A very sharp

graver is now taken, and the sides of the collar roughened by turning up little burs at different angles on them.

We next soften and remove the composition, and trim up the collar into shape (Fig. 15) for the tooth and also to the bite.

The posterior border of the collar may be nicked with a fret saw or sharp shears, and bent slightly inwards, so as to more securely hold the body and also the better to restore the contour of the posterior cusp. The next business is to fit the

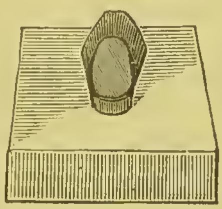


Fig. 15.

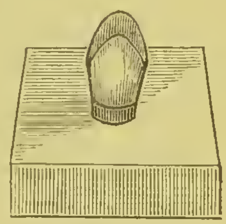


Fig. 16.

tooth and tack the pins to the cap or sides of the collar with fine gold, but it is practically immaterial whether it be soldered or not, or even whether the tooth have pins, as on fusion the whole becomes cemented as one piece ; it however makes the manipulative process easier.

After the tooth has been soldered to the collar (Fig. 16) the latter should be painted inside and outside with a thin coating of enamel, corresponding to gum enamel only different in colour. This is dried by gently warming the crown, which can be conveniently held by a simple arrangement (Fig. 17).

Fig. 17.

It explains itself and enables one to do the delicate work without touching the crown with the fingers.

After the enamel is dry a very thin layer of mineral compound is also painted around the collar, and the inside of the collar is filled up with mineral compound (of a somewhat lighter colour than that used for continuous gum work) and the contour of the tooth is completed, and its articulation with the bite perfected.

Now it is a great satisfaction to know that as we put the tooth in the furnace to fuse, so it will turn out perfect in form

The firing may be accomplished in a small platinum tray in the electric furnace, and I cannot speak too highly of Mitchell's for this purpose ; it is a comfort to work with.

The crown may or may not be buried in silex during the first firing : if covered in silex there is less chance of the tooth cracking.

The heat should be allowed to get up, and a small piece of pipe stem with some compound on it may be placed so that it can be removed readily for observation. With a little practice one can dispense with test pieces as the heat is so regular.

When fused, the tray containing the crown should be removed and cooled down.

The further treatment is to clear off any adherent silex, fill in any little blemishes there may be with mineral compound, and paint over with an enamel corresponding to the colour of the tooth, or tinting the tooth and all with enamel to match its neighbours.

In placing the crown in the tray for the final firing, do not let the enamel come in contact with silex ; it should rest on a little pedestal of plaster. The æsthetic appearance of a

porcelain crown, with all metal covered up, is far beyond that of an ordinary porcelain faced bicuspid, and not inferior in strength.

The three following illustrations will perhaps serve as an example of the manner of construction of a small bridge, or more properly speaking, narrow plate to carry three teeth, the lost natural gum being restored by a porcelain substitute to prevent the cheeks from falling in.

The different parts are made of No. 5 soft platinum.

In Fig. 18 A is the cap and dowel to fit on to the canine root. B is the cap that is to be cemented on to the molar root ; this has a thick boss of metal in the centre, which is tapped and fits into the recess made in the molar root. C is the plate which has several small tags soldered to it. D is a piece of platinum struck up to the plate and molar root. This piece must be strengthened by bending and soldering with fine gold, a piece of flattened wire around its circumference, and extending to

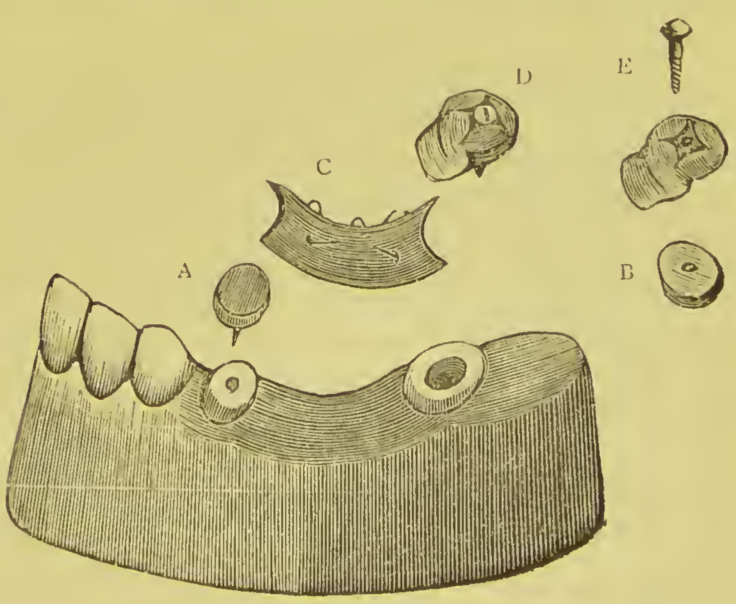


Fig. 18.

the plate to which it is soldered. A hole is now drilled in this crown piece for the reception of the screw E.

Fig. 19. Shews the plate and its several parts soldered together. Fig. 20 shews the perfected piece. The canine tooth is the only one that is backed and soldered to the plate, the others are mounted in the mineral compound as before described, the crown piece over the molar being built up to

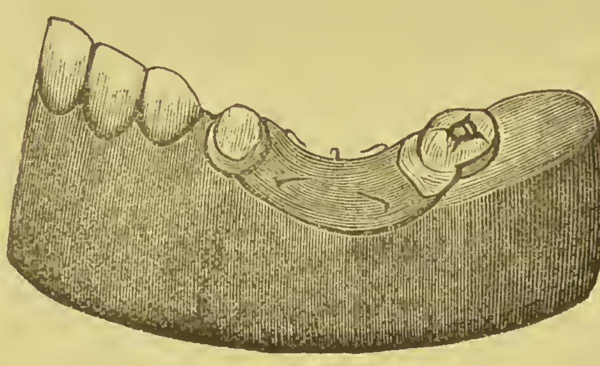


Fig. 19.

the bite with mineral compound. It is now painted with gum enamel and fired.

This case is only described here as an example of porcelain work. The method of application is not advocated by the writer. For such a case he would prefer the canine and molar roots to be crowned and a small removable plate inserted, such an one as could be kept absolutely clean.

Soldering Teeth to the Plate when the Bite is very Close.

It has been mentioned that it is necessary in short bite

cases to solder the teeth to the plate. In a great many cases

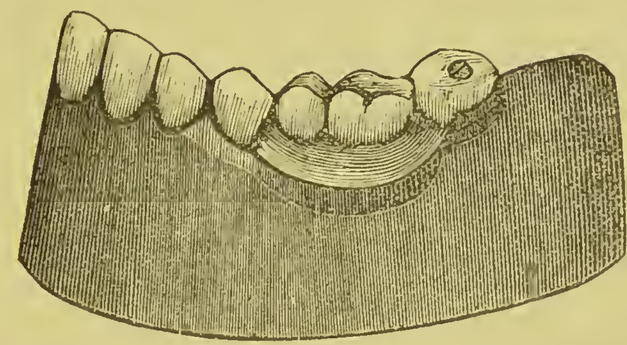


Fig 20.

bending the pins so that they touch the plate and can be tacked to it with fine gold is only necessary.

In others again one must make a contact between the pins of the teeth and plate by interposing a piece of wire or plate, and in some cases it may be essential to back and solder the teeth.

Whichever way is found necessary the soldering may be effected during the first firing by leaving exposed the part that has to be soldered. When the fine gold which one uses as solder is in position small slips of damp tissue paper may be pressed against the backs of the teeth and the case then inserted in the silex and fired in the ordinary manner. The paper to a great extent keeps the silex from the gold during the investment.

Selection of Teeth for Continuous Gum Work.

In the selection of teeth one must take into consideration their hardness or infusibility at temperatures necessary for

the fusing of the body or Mineral Compound, and secondly, their artistic or natural appearance; both these considerations are highly essential, for the partial fusing of teeth means loss of shape and probably colour. The chief beauty in this work is to imitate nature as nearly as possible so that unshapely teeth would be perfectly inadmissable.

There is yet a third qualification, and that is to be able to stand fire without cracking. Fortunately our principal makes, both English and American, possess this qualification, so that one is able with proper precautions to avoid this trouble occuring.

Of all teeth used for Continuous Gum Work diatoric or drilled teeth are the most unreliable, because if any shrinkage of the Mineral Compound or Body takes place in the holes of these teeth and air gets imprisoned in them, it is very likely to blow to pieces when heated, if at any time it should need repair.

This imprisonment of air in its interstices is the chief difficulty in repairing Continuous Gum dentures, for directly the case gets to a certain temperature, the expansion of air is so great, that it will blow the added portion right away.

It is better to use solid teeth with no holes in at all than diatorics.

The tooth that one wants for Continuous Gum Work is a natural pattern, both back and front with no pins or holes of any kind. Pins are not necessary as the teeth become one with the body after firing.

Speaking of blows or air holes, a case occurs to me where an air hole appeared in the body just at the neck of a canine tooth, due to defective packing in of the Mineral Compound.

I filled this hole up as carefully as I could with body, dried

and fired the case, but to no purpose, the added portion blew out at a red heat and the hole was still there. On passing a very fine nerve bristle into it, I found it extended right under the tooth until it came in contact with the plate.

I then drilled a small hole through the plate from the under surface, and was fortunate enough to hit on the spot where the hole in the gum led to, so a free opening was thus established. The hole was then filled up again with compound, and this time successfully.

A still more forcible example shewing the difficulties of repairing this kind of work occurs to me. It was certainly a very defective case. In the attempt to repair it, before it came under my observation, several kinds of body had been tried without success, the case, a complete lower, having the appearance of a sponge on being ground.

It was evidently over-fused, and was so full of bubbles that I had to grind all the gum and body away except a little that supported the teeth, and even that was so porous that it took four or five firings before a proper surface was obtained.

It was only by filling the holes up with perfectly dry material (Body) that I ultimately succeeded, the dry material allowing the air to escape.

If the holes were filled with damp material in the ordinary way it blew out at once at a red heat.

It therefore behoves one when packing a continuous gum case to condense the body as much as possible, and so prevent the formation of these air spaces.

These examples are mentioned with the object of shewing some of the difficulties one has to encounter in repairing these dentures.

Another example still more recent was that of a patient for

whom I had made an upper continuous gum set. As the patient in this instance thought that the gum enamel was rather too thick in front and made her lip more prominent than she thought desirable, I removed some of it, at the same time informing her that I would re-enamel the case again.

It is one thing to promise and in some cases quite another to perform. However, to proceed, I first of all boiled the case in soda water for a quarter of an hour, then I placed it in H.Cl. to clean the plate, then I boiled it again in soda water for a short time, finishing up by washing it with soap and water.

After carefully drying I painted the case again all over with gum enamel and then started the blast furnace. I placed the case in a nickel pot and warmed it up for a considerable time, ultimately inserting it in the muffle. To my amazement pieces of the gum began to fly off at a rapid rate, and to cut the story short, it was in my opinion a miserable failure, for not only was it bare of enamel in places but a portion of the side of one front tooth had also blown out.

The patient wore it for a few days until an opportunity occurred again for another trial, when I contented myself by simply washing the case in soap and water, after I had ground off the inequalities in the body, etc.

I then ground the defective front tooth out and fitted another in its place, and fixed it in position with mineral compound, and a layer of gum enamel over all.

Now it occurred to me that perhaps the boiling so long in soda water on a previous occasion had practically insured moisture being drawn into any porous places existing in the work, so I refrained from that. It also struck me that perhaps the nickel pot conducted the heat too rapidly, so I

determined to give it a preliminary heating covered up in silex. It must be here noted that the case was covered with gum enamel and should the heat be sufficient to melt that, the silex would of course stick to it. So the problem resolved itself into this : how can one prevent silex from adhering to the gum enamel at a red heat? I managed it in this way: A layer of silex was placed in the pot and pressed down hard, then the case was laid gently upon it. I next took a leaf of No. 4 gold foil and laid it over the set, silex was then poured on the foil, thus adapting it to the case, and the case was then completely invested. No mishap occurred when heating the case up under these conditions, and the subsequent firing of the gum enamel in the ordinary manner was perfectly satisfactory. I think one may gather from this case that a preliminary heating, say to a dull red is essential to the safety of the case in the final firing and fusing of the gum enamel.

In the first heating up the gold foil was not melted.

Replacing a Fractured Tooth.

Let us imagine, for example, it is a front tooth fractured in a full upper Continuous Gum set.

It is first of all necessary that we boil the case in strong soda water for at least a quarter of an hour, after which it is removed and well washed with soap and water, and thoroughly rinsed in clean cold water and dried.

The portion of broken tooth remaining is now cut away with a suitable corrundum or carborundum wheel, and a new tooth fitted carefully to the space. We next paint the part that has been ground with a little gum enamel, and also the back of the tooth, then some moistened mineral compound is placed in the space and the tooth pressed home.

The tooth may be supported by the finger while mineral compound is condensed around it. When hard, a good thick layer of gum enamel should be painted on, in fact, it is as well to paint a very thin layer of gum enamel over the whole of the case, this melts and protects the surface and prevents it losing its colour.

The case is inserted in the firing-pot so that it rests steady, after which it should be very carefully warmed, and heated up and fired with the usual test-piece, viz., a piece of pipe-stem, with some gum-enamel on the centre, the ends resting on the edges of the pot. Only one firing is required for such a repair, and the contact with silex avoided.

To repair a gum facing that is mounted in vulcanite, when the porcelain gum is implicated as well as the tooth, one may cut the fractured part to a convenient shape and then make a small gum section to fit in the space, and insert fastenings to retain it in position when vulcanized.

To fix swivels to a Continuous Gum Case after completion.

On one occasion I found it necessary to fix swivels to a lower continuous gum set; it was done in the following manner: two recesses were made by means of a carborundum point of a sufficient depth to allow the shortened bolt of the swivel to enter. Gold washers large enough to cover the recesses were next soldered to the bolts, the ends of which were next flattened and roughed.

The interior of the recesses after being made undercut, was cleaned with a little chloroform and then painted with chloro-rubber, rubber softened was then packed in. The swivel bolt was next made hot and pressed into position, the washer covering up the rubber. The case was next inserted in a flask and vulcanized.

Tinting the Teeth on a Continuous Gum Denture.

This process is effected by different coloured enamels which fuse at the same time as the gum enamel, in fact they are identical with that, except in colour.

The proper time to do the tinting is just after the first firing, that is the fusion of the body, and before the painting on of the gum enamel.

When the tinting is completed the gum enamel may be painted on and the firing completed.

To acquire skill in this branch a careful study of old natural teeth, both in and out of the mouth should be made even old artificial sets, brown and discoloured by smoke and age, will afford one a very good idea of tinting teeth to produce a natural effect.

Furnaces.

The furnace that I have used for the last five years is one of Nelson's (Fig. 21), and is heated by his patent petroleum

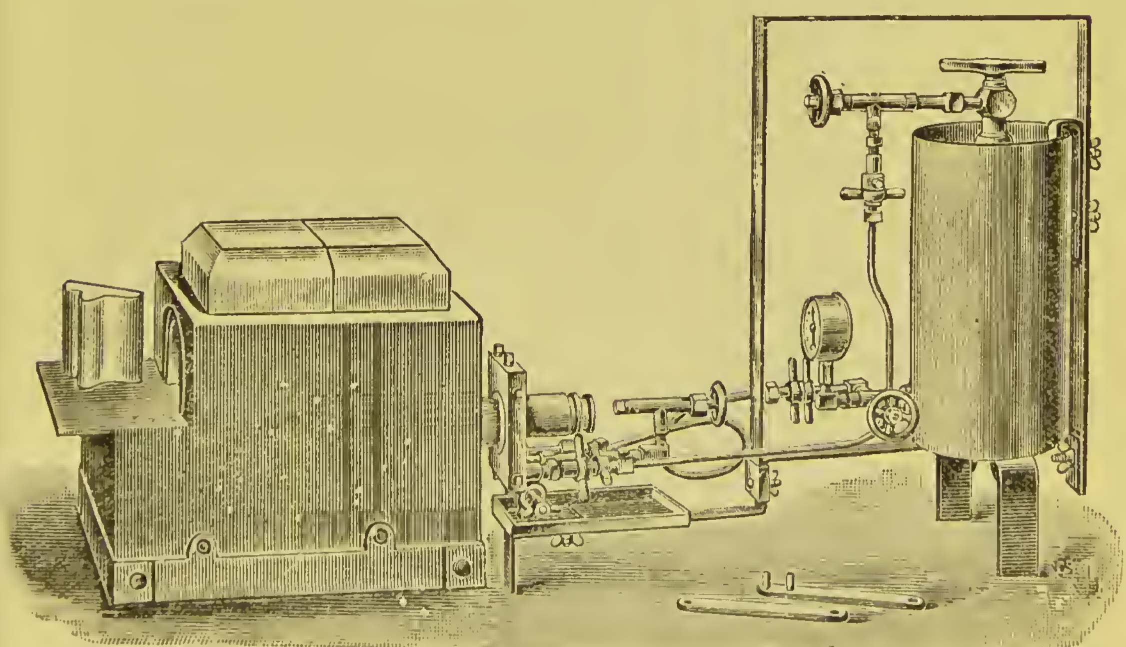


Fig. 21.

blast. This apparatus has given me a great amount of satisfaction on account of its uniform and perfect results. It can be so easily regulated that one is able to increase or decrease the amount of heat at will ; this of course is extremely valuable when one has such fine work to do.

The blast works automatically, so that one is enabled to give his undivided attention to the work. Starting from the cold one is able to fire a continuous gum set in three quarters of an hour, at an expenditure of about sixpence for benzoline.

The muffle is of sufficient size, a very great consideration, to take a pot that will hold two cases, and enable one to carry out the details of investment as recommended in these pages.

I have never seen a case gassed or smoked in this furnace, in fact the petroleum vapour does not discolour the gum even when it is fused directly in it. In any furnace, electric or otherwise, I look upon it as being absolutely essential that the working space in the muffle should not be cramped, and that there should be sufficient room for a pot in which to invest the case completely in silex.

For nearly twenty years prior to the introduction of Nelson's Automatic Blast, I used the coke furnace. One however, gets spoilt for a coke furnace after using the blast, but still with all the drawbacks incidental to it, such as the dirt in lighting, chances of getting the case smoked by the muffle cracking, or overdone, owing to the heat constantly varying, good work can be done if proper care and intelligence is displayed. It has the merit of simplicity, and can be used when other means are not at hand.

I have to fall back on this furnace even at the present

time, when from want of spirit or other cause, the Blast furnace is not available.

In coke furnaces the temperature is always increasing or decreasing, this is more especially apparent in small furnaces, so when using such an one, the case should be under observation until finished.

Some amount of care is necessary in stoking, the pieces of coke should be broken to such a size that they will pass readily down by the side of the muffle.

It is as well before introducing a case in the muffle to have a nice clear fire up to about the top of the muffle, then the furnace is filled up with more coke, and when the dust has cleared away, the case should be carefully introduced, leaving the door of the muffle out. After the case has become quite red hot, the door of the muffle may be placed in position, and the case fired while the temperature is rising. Tongs and everything necessary for the immediate withdrawal of the case from the muffle should be at hand, and the receptacle warmed, in which the case has to cool down.

When taking out the test piece the firing pot should be drawn to the front of the muffle and pushed back again if not done, the heat is usually so great that two or three minutes more than is necessary is quite sufficient to spoil the case.

With regard to high fusing bodies, it is only by comparison with the teeth they are used with, that they can be so called.

The reason why the early French blocks were such signal failures was because of their high fusibility, and one may rest fully assured that there is not a mineral tooth made at the present day, that could stand alongside one of those blocks

in the muffle and not run to a bead. The old French teeth were mainly china, clay and silex with a small percentage of spar, and so fusible that to produce a surface they had to be glazed.

Continuing we find, many years after, Dr. John Allen introducing a much lower fusing material, thus enabling him to use American teeth of the present date, thus if it was necessary or desirable, a much higher fusing body could be used with S. S. White's teeth than with any of the English makers, but it is not desirable. What one wants in a body is that it will admit of his using at any rate the teeth of the best English makers, as well as that he may not be handicapped in his selection, and have to send a few thousand miles for something he has an immediate want for. But such a body could not be called a high fusing one.

Secondly, the body should retain its shape when properly fused, have the requisite strength and a freedom from shrinkage.

Repairing the Muffle.

After a firing, if small cracks or flaws appear in the muffle, they should be filled up on the outside with some wet fire-clay which has had chopped tow or sawdust mixed up with it, and a little thick china clay, or plaster of Paris and brick-dust, should be rubbed into the cracks on the inside. Any cracks or spaces round the front or opening to the muffle must also be made good with plaster of Paris.

Making Fire-clay Muffles, Trays, etc.

The ingredients necessary are:—

1. Fine quality fire-clay.

2. Pounded fire bricks or old fire trays, clean and free from clinker.

3. Chopped hay cut into about half-inch lengths.

The proportions are two-thirds of 1 to one-third of 2 with a small quantity of 3, which should be mixed with water and kneaded into a stiff paste; the mass should then be allowed to mature for three or four days before using.

If our object, for instance, is to make a muffle, it is now necessary to have a model or mould of the same in zinc or tin, upon which the clay is moulded, and it should correspond in size to the inside diameter of the muffle. Such a mould is made in the following way (see Fig. 13); A represents a piece of wood half an inch thick, the sizo of the floor of the muffle. B represents pieces of wood to screw on to piece marked A. C is the metal casing of zinc or tin which must be perforated along its borders to receive nails for securing it to A and B. A handle should be screwed to one of the B blocks to permit of its being withdrawn from the clay muffle when dry.

We now require a covering to fit the mould. This may be made of some light material, such as thin calico. It must fit the zinc mould and have an open end, so as to slip off and on. The seams should be neatly made, and when stretched on the mould the bag must be free from wrinkles.

Moulding the Clay.

A lump of the clay previously mixed is now taken and kneaded until it is sufficiently tough to permit of its being rolled into a sheet. A little fine dry fire-clay can be used to dust the roller, and also the thick cloth or canvas upon

which it should be rolled. The canvas may be tacked or fastened down at the corners to prevent its moving.

When the clay has been rolled the proper thickness—say half-an-inch for a medium sized muffle—a rough paper pattern should be taken of the mould and then placed on the sheet of clay which is cut to the size of the paper. The rolled clay should now be raised, and a sheet of paper placed under it.

The mould, with its calico covering, is placed in position on the rolled clay, which is then wrapped over and moulded to it, and join in the clay muffle being made at the lower border or along the centre of the top of the mould.

When the clay has been accurately moulded, and all joints made good, the raw muffle and mould should be placed on one side, until the clay hardens sufficiently to retain shape, after which the mould is withdrawn.

The calico covering prevents the clay from adhering to the mould, and can be drawn from the inside of the muffle afterwards.

If it were not for this calico covering, the soft muffle would be drawn out of shape on the attempted removal of the mould.

The raw muffle is now placed on one side to slowly harden for a week or ten days.

Several of these muffles should be made at a time, as they do not take long to manufacture when once the material is prepared.

Fire clay pots and trays are moulded to a piece of wood of the required shape and size, and covered, as in the case of the muffle mould, with a piece of thin calico. When these fire-clay articles are quite dry and hard, they may be placed

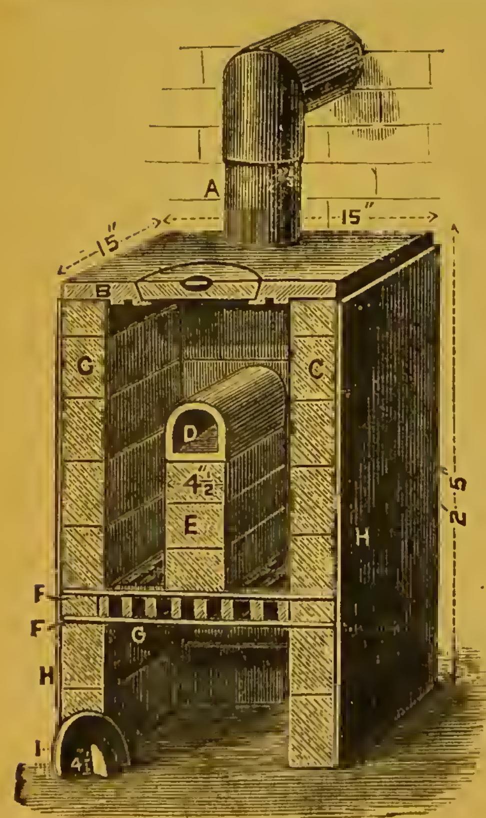
near a fire for a day or two, and ultimately warmed up on the top of the furnace; they will then be ready for the final process, which is to bake them in the furnace, keeping them red hot for two or three hours, or until the muffles assume the colour of a baked fire brick. Any dark smoky appearance about the muffle shows that it is not properly cooked, and must be fired again before being used. An improperly baked muffle, or one made from impure ingredients, is liable to interfere with the success of the work. The pots and covers may be fired at the same time inside the muffle.

In firing the raw muffle a clear fire should be made first of all in the furnace, and then damped down by being covered with small coke. The muffle having previously been made hot, is now introduced into the furnace, resting on the bricks along its whole length. The front should not be fastened and filled in until the muffle is properly baked.

When fixed permanently, the space between the front of the muffle and the furnace should be filled in on the inside of the furnace with fire-clay, and on the outside with plaster of Paris.

The "Record" Furnace is the kind I invariably use and recommend. It is composed of an outer iron case lined with fire-bricks or fire-clay slabs, and a solid iron top and piping. A represents the piping, which must be of such length as is required by the position of the furnace. B is the lid in the centre of which will be seen a movable portion through which the fire is stoked. C C are the fire-bricks on edge. D is the muffle resting upon a brick 4 in. wide, and instead of two other bricks under this in the position shown in sketch, one brick is to be put on edge; this will rest on two or three of the fire-bars G. F F are pieces of iron

placed in when building the brick-work, and the same number are fixed at the back of the furnace, the bars G resting on the lower portions and leaving just sufficient space below the upper ones to withdraw the bars when firing is completed. H is the outer iron casing which secures the whole. I is the muffle door. The sketch is shown in section. The joints of the brickwork should be made good with fire-clay so as to prevent an escape of heat and smoke, and the iron roof should rest upon fire-clay. The face of the muffle should be brought about level with the inner face of the front bricks, and the space round the outside made good with plaster of Paris. With these directions any ordinary workman will be able to build a furnace readily.



INDEX.

ASH'S
PORCELAIN ENAMELS
For Shading Artificial Teeth

AND

ASH'S
MINERAL BODIES
For Inlays, Crowns and Bridges

MARCH, 1912.

CLAUDIUS ASH, SONS & CO., LIMITED,
5 to 12, Broad Street, Golden Square,
London, W.

ASH'S PORCELAIN ENAMELS,

For Shading Mineral Teeth and Inlays.

These Porcelain Enamels are made from the same material as our Low-fusing Mineral Body.

They are very fine in texture and can be most easily spread over the surface of Mineral or Porcelain Teeth.

They can be fused on to any make of teeth, and are warranted not to wear off in the mouth. Their fusing point is about 1,600° Fahrenheit (871° Centigrade), and when they are properly fired they become so permanently a part of the teeth which are coated with them that they will stand any test to which they may be subjected, either in soldering or vulcanising. To keep such teeth perfectly clean it is an advantage to press a small piece of gold foil over them, with the fingers, before soldering or vulcanising.

The simplicity of the Outfit and of the Enamelling Process brings this beautiful work within the practical reach of every Dentist.

We supply them in the following eight colours :—White, Grey, Blue, Dark Green, Dark Brown, Light (Italian) Brown, Black, Yellow, put up in bottles and packed in a neat cardboard box.

To mix the colours :—Mix the colours on the porcelain palette with an Agate, Ivory, Bone or Tantalum Spatula, add sufficient mixing liquid (Oil of Cajeput) to render plastic, and work the mixture with the spatula until it is thoroughly smooth and thin.

The colours White, Grey, Black should be thickly applied to the teeth, but Green, Blue, Yellow and the Browns must be thinly applied, in order to obtain the best results.

To ensure a uniform layer after painting, when using the Yellow shade to colour the neck of a tooth, hold the pins of the tooth with a pair of tweezers, invert the tooth and give the tweezers a tap or two with the spatula ; this will cause the enamel to flow evenly over the surface of the neck of the tooth.

To test a Shade :—Before applying the mixture to the teeth which are to be shaded, test it on a useless tooth or piece of porcelain to see whether it is the right tint. When the right tint is obtained, carefully paint it on the teeth to be shaded with a camel-hair brush, let the material dry naturally and then fire in any suitable gas furnace or in any electric furnace until the teeth are well glazed.

The depth of shade desired is obtained by varying the thickness of the enamel when painting it on the teeth.

Gum Teeth :—A good imitation of the natural gums can be produced by using our High-fusing Gum Enamel, No. 159 B—for price see below.

Defects in the Teeth :—By drilling or grinding the surfaces of Artificial Teeth with a Diamond Disc, a Diamond Drill, or a Diamond Bur, and afterwards applying an enamel, and firing, pits and grooves in the enamel of Natural Teeth can be effectually imitated.

For Tinting Mineral Inlays and Crowns :—Should the colour of an Inlay or Crown not be a satisfactory match, it can be tinted to the desired shade with one or other of the enamels.

General Remark :—In the hands of the artistic worker, there is hardly any limit to the possibilities and usefulness of these Porcelain Enamels. It is scarcely necessary to add that a number of intermediate shades can be obtained by blending the colours which we supply.

---

	s.	*d.*
Box containing 8 bottles of Porcelain Enamel, 1 bottle Mixing Liquid (Oil of Cajeput), Ivory Spatula, Porcelain Palette, 2 Camel-hair Pencils and Nickel Tray . . .	15	0

NOTE.—The Camel-hair Pencils should be cleaned with Turpentine before being used for applying a fresh colour.

Gum Enamel, No. 159b, for veneering the cervical border of Teeth and Crowns, per $\frac{1}{4}$-oz. bottle	2	6

ÉMAUX EN PORCELAINE DE ASH

Pour Nuancer les Dents Minérales et les Inlays.

Ces émaux de porcelaine sont faits des mêmes matières que notre corps minéral à basse fusion. Ils sont d'une texture très fine, et peuvent être facilement étendus sur la surface des dents minérales. Ils peuvent être employés sur toutes marques de dents, et sont garantis contre l'usure dans la bouche. Leur point de fusion est 1600° Fahrenheit (871° C.) environ. Quand ils sont cuits correctement, ils font si bien corps avec les dents qui en sont enduites, qu'ils résistent à toutes les épreuves que l'on peut leur faire subir, soit au moment du soudage, soit durant la vulcanisation. Pour tenir ces dents parfaitement propres, il est préférable d'appliquer sur elles avec les doigts une petite feuille d'or, avant le soudage ou la vulcanisation.

La simplicité du matériel et du procédé d'émaillage place ce beau travail à la portée de tout dentiste.

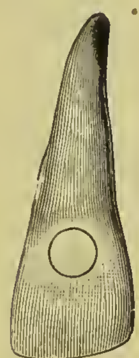
Nous faisons ces émaux en huit couleurs : blanc, gris, bleu, vert foncé, brun foncé, brun clair, noir, jaune, contenus dans des flacons et empaquetés dans de jolies boîtes en carton.

MR. DALL'S

METHOD OF INLAY WORK.

TREATMENT OF SIMPLE CAVITY WITH INSERTION OF PLAIN INLAY.

FIG. 1.



INSTRUCTIONS.

First.—Clean the surface of the tooth by using, in the engine, a fine carborundum point or paper disc, so that the decayed or soft parts can be seen to their full extent.

Second.—Enlarge the cavity with sharp rose-headed burs and one or two inlay burs, make a slight groove with grooving bur at base of wall, select inlay same size as bur, fix with phosphate cement, dry with hot air, and when dry grind the surface of the inlay with carborundum points, which still further tends to harden the cement; finish with water of Ayr stone, buff and pumice.

TREATMENT OF TOOTH FOR SUPERFICIAL DECAY OR DISINTEGRATION OF ENAMEL, FOR INSERTION OF PLAIN INLAY.

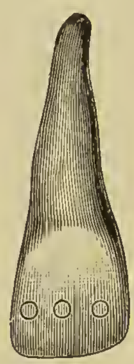
No. 1A (*No Illustration*).

Same instructions as for Simple Cavity—see Fig. 1 above—with one exception, viz., use diamond burs until beyond the enamel, and enlarge slightly with same before using the rose-headed burs.

MR. DALL'S METHOD—*continued.*

TREATMENT OF CAVITIES IN PITTED TEETH FOR INSERTION OF SMALL PLAIN INLAYS.

Fig. 2.



Same instructions as for Simple Cavity—see Fig. 1, page 17—with one or two exceptions, viz., rose-headed burs need not be used, the inlay burs can be employed from start to finish, moreover, a groove at base of cavity is not necessary.

TREATMENT OF SMALL CAVITY NEAR CUTTING EDGE FOR INSERTION OF PLAIN INLAY.

Fig. 3.

Same instructions as for Pitted Teeth—see Fig. 2, above.

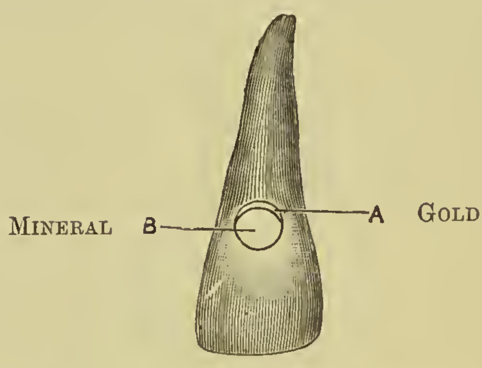
The Tapering-cone Bur, mentioned on page 13, will be found very useful for Cavities of this class, especially when it is necessary to drill right through the tooth, in which case a tapered inlay is inserted corresponding to the size of the bur used.

The operator must be very careful, while enlarging cavity, not to exercise pressure on the bur towards the cutting edge, as thereby it would be weakened.

MR. DALL'S METHOD—*continued.*

TREATMENT OF SIMPLE CAVITY AT CERVICO-LABIAL OR CERVICO-BUCCAL SURFACE, WITH INSERTION OF SEMI-APPARENT GOLD-BORDERED INLAY.

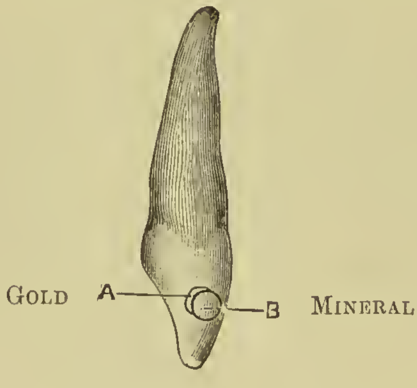
FIG. 4.



Same instructions as for Simple Cavity—see Fig. 1, page 17—but Gold Line to be burnished after it has been polished with Buff and Pumice.

TREATMENT OF IRREGULAR CAVITY ON THE DISTO-LABIAL OR MESIO-LABIAL SURFACE, FOR INSERTION OF PLAIN INLAY WHERE ONE TOOTH IS CONTIGUOUS TO ANOTHER.

FIG. 5.



INSTRUCTIONS.

First.—Clean surface around decayed part by using in the engine a paper disc and remove decay with rose-headed burs.

Second.—Next use a very shallow inlay bur, or preferably an interstitial inlay bur, then fill the irregular part of cavity with gold foil, cylinders or solila-gold, encroaching on the part where the inlay is to be fixed.

Third.—Again use the inlay bur, select and fix inlay; finish as in the case of Simple Inlay, but use emery paper discs more freely.

MR. DALL'S METHOD—*continued.*

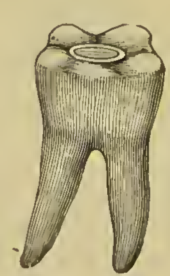
TREATMENT OF CAVITY IN UPPER OR LOWER BICUSPID OR MOLAR, FOR INSERTION OF PLAIN INLAY.

FIG. 6.

Same instructions as for Simple Cavity—see Fig. 1, page 17.

TREATMENT OF GOLD-BORDERED INLAYS FOR UPPER AND LOWER MOLARS AND BICUSPIDS.

FIG. 7.



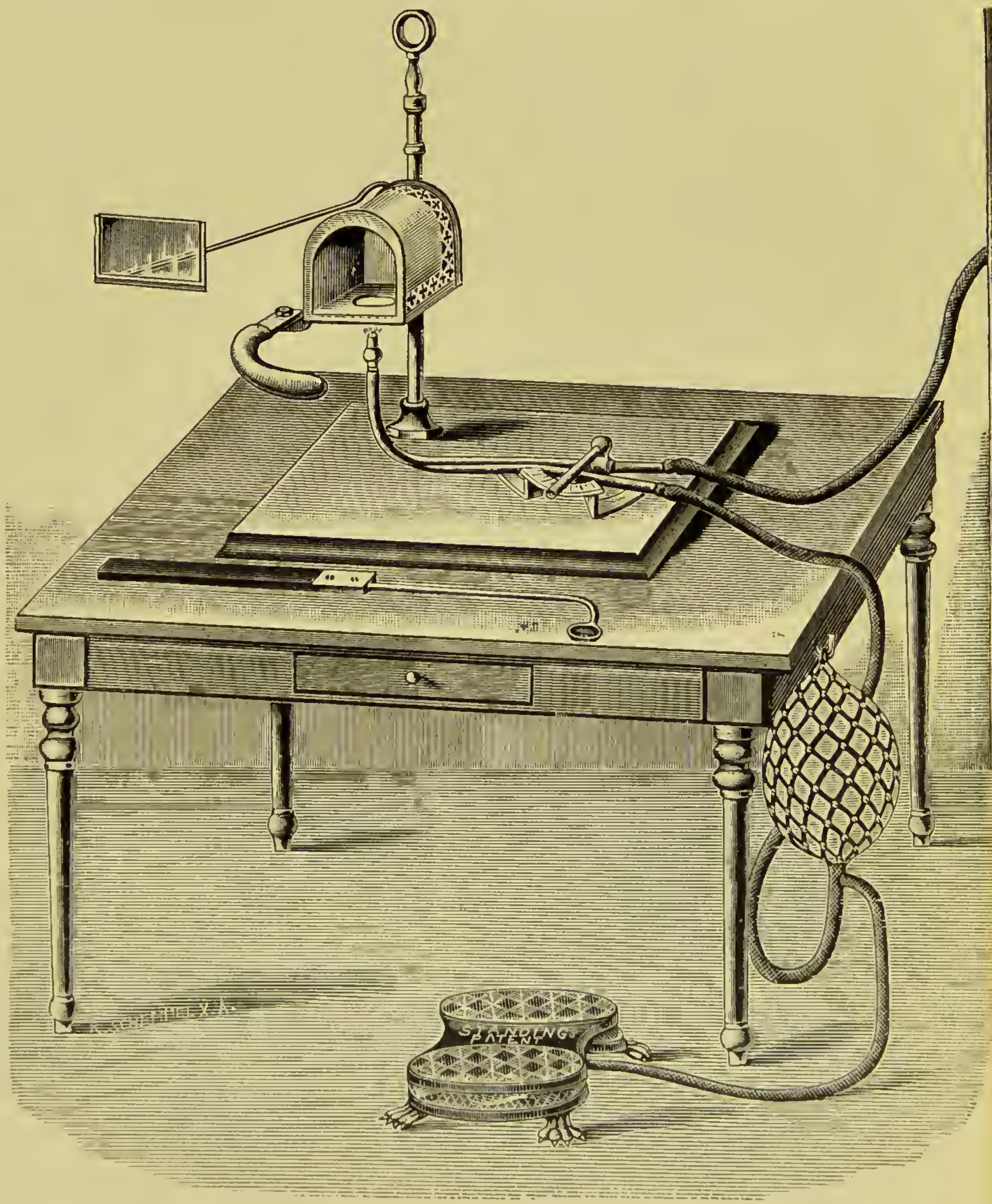
Same instructions as for Plain Inlays—see Fig. 1, page 17—only Gold must be burnished after it has been finished with Buff and Pumice.

DR. JENKINS'

GREATLY IMPROVED PORCELAIN ENAMEL OUTFIT

—continued.

HEATER, BLOWPIPE AND BELLOWS.



Supplied by CLAUDIUS ASH & SONS, LTD.

DR. JENKINS'
PORCELAIN ENAMEL.

DR. JENKINS says:

"This material contains the ingredients and possesses the properties which its name indicates. It is the result of several years' continued experiment in the laboratory and in the mouth, the scientific and the practical experiments going on simultaneously.

"In its now completed form, it furnishes a perfect material for filling almost all cavities which are in condition to receive permanent treatment. In the hands of skilful practitioners it will inevitably supersede gold in a great proportion of cases, when once they and their patients are familiar with its qualities. It is not a material for careless or incompetent operators. Its successful use requires the highest qualities of skill, taste and judgment, and it will be unwise for any dentist to attempt to do cheap work with it. The material is expensive to produce as the process of manufacture is a very complicated one, but, of course, it is far less expensive than gold, and therefore, before being familiar with the care and time which its use requires, some may make the mistake of charging for it a smaller fee than for gold, whereas patients will gladly pay more for it than for the most elaborate gold work, and no dentist can afford to work it as it should be worked except for a good fee. It resists acids, is not stained by sulphides, does not change in colour, nor disintegrate in the mouth, is perfectly tolerated in cavities which, under gold, would be continually sensitive to changes of temperature, accurately restores the form and colour of the teeth, and can be successfully used in many cases where otherwise artificial crowns would be made. It can be melted to an exact line, and yet flows so slowly that any desired contour can be obtained. For crowns, for attaching artificial teeth to pivots, and for covering platinum bands on pivot teeth, it is extremely valuable.

DR. JENKINS' PORCELAIN ENAMEL—*continued.*

" An apparatus for melting this Porcelain Enamel has been invented, every detail of which has been carefully elaborated, and the use of which is indispensable to the process except an electric furnace is employed."

The following are Dr. Jenkins' Directions for Making Inlays.

"**The Cavity.**—Prepare the cavity with clear and well polished edges, avoiding undercuts, and observe beforehand in what way the impression can be most easily removed. In an approximal cavity, be sure to have room enough to work out the impression, and to insert the filling when it is completed. If the impression is taken without putting on the cofferdam, dry carefully, and, if the gold foil must infringe upon the gum, paint a thin film of vaseline upon the gum, to prevent the foil from sticking. In many cases, after thorough drying, a film of vaseline may often be painted over the entire cavity with advantage.

"**The Impression.**—It should always be taken in gold foil, as Platinum foil is too stiff and too thick for perfect work. Gold foil No. 30, whether cohesive or non-cohesive is a matter of indifference, is best adapted to most cases. In large and complicated cavities, No. 40 is sometimes preferable. Take a piece of foil, of the desired size and shape, and press it first into the deepest part of the cavity, with a small piece of cotton or spunk. Continue then to pack other pieces until the foil perfectly fits the cavity and laps over the edges everywhere without irregularities or wrinkles. Sometimes it is necessary to burnish the foil, but often packing is sufficient to give perfect edges. Remove the packing piece by piece, and examine the gold carefully to make sure that the impression is exact. A slight tear in the foil, if not at the edge of the cavity, will do no harm, but, after some experience, nearly all impressions can be taken without a break in the gold. With a fine excavator touch the overlapping gold here and there, especially at the gum margin, until the matrix loosens. Then coax the gold out gently. Each case is a law

DR. JENKINS' PORCELAIN ENAMEL—*continued.*

unto itself as to how this can best be done, but, with sufficient care, a perfect impression of every well-shaped cavity can certainly be obtained.

"**Selecting the Colour.**—This should be done while the tooth is still wet, since dryness will bleach every tooth, and the colour of the inlay must correspond to the tooth in its normal moist condition. In approximal cavities in the incisors it is sometimes well to select a colour a trifle lighter than that of the natural teeth, because of the shadows, but in most instances it is better to select the colour to conform to nature as nearly as possible. There are eighteen colours with every outfit, specimens being arranged upon two ivory fans of nine colours each. These have been selected out of a great number of colours and will give a sufficient variety to answer the purposes of the widest practice, unless it be in abnormal cases. Any desired colour can be furnished upon demand. The specimens on the fans represent the result of normal melting. Too rapid or excessive melting will lighten, and insufficient melting will darken these colours in a measure; but by judicious treatment they will remain constant to the pattern.

"**Melting.**—Mix the powdered asbestos with water to the desired consistency, and place upon the bottom of the platinum cup for inlays sufficient to imbed the impression. Generally a slight tapping of the cup will settle the impression in place. Should some of the walls, however, be too high, a little of the asbestos should be carried under them with the sharp point of the ivory instrument designed for working the powdered asbestos, so that the impression is everywhere equally supported. Place upon the agate palette, which is unpolished for convenience of taking up the powder with the spatula, a small quantity of the selected colour, and mix it with absolute alcohol. With the small, thin blade of the spatula, take up some of the well-moistened powder and fill up the impression, taking care not to overflow the edges. If, in packing, the powder gets too dry, either in the impression or on the palette, add more absolute alcohol with the drop tube. Avoid dirt and dust. Put the small cover on the melting cup, with the

DR. JENKINS' PORCELAIN ENAMEL—*continued.*

opening toward the handle. Then hold the cup across the hole in the heater, keeping it about in the middle, and turn a very fine flame from the blowpipe, on the handle, about an inch from the melting cup, thus gradually drying the asbestos. Do this without hurry. The moisture must be evaporated, not boiled out. This done, gradually turn the flame upon the bottom of the cup, slowly and gently increasing the flame and the draught from the foot-bellows, until the porcelain enamel is melted. No violent action of the bellows is necessary. A small flame and a little draught is sufficient in most cases. It is of no consequence if the first melting is rough and irregular. The material is not designed to flow easily. When the powder begins to melt, hold the flame and draught as it is, and do not try to accelerate the melting by rapidly increased heat. With care and patience anyone can learn to melt this material so that it forms a solid mass, free from bubbles and constant in colour. The process of melting can be clearly seen through the opening of the platinum cover, and, if the glow is trying to the eyes, they can be protected by the tinted glass screen on the adjustable arm. The first melting will not be sufficient, as the powder greatly contracts, but the cover can be at once removed and cooling facilitated by wetting the bottom of the cup with water, as the material is not liable to crack. Then pack the impression with powder, as before. Keep wetting it with alcohol if it dries too quickly. It does no harm if the asbestos becomes moistened with alcohol, but avoid wetting it with water for a second time. Turn a small flame, as at first, on the handle, and presently a blue flame will appear at the opening of the cover. Let it burn until the alcohol is quite consumed, and then melt as before. Generally a third packing and melting are necessary for exactness of edges and contours. Examine the inlay with a magnifying glass, to be sure if the edges are exact, both in packing and after melting. The tendency, in the beginning, is to contour over much, but after some experience one learns to get exactly the form and fulness desired. When perfectly melted, the inlay can be ground, and then polished with an Arkansas stone, but it is better to have it so exact in shape as to retain the polish given by melting. After the final melting, it is best to let it cool somewhat slowly.

DR. JENKINS' PORCELAIN ENAMEL—*continued.*

"**Removing the Gold Foil.**—When the inlay is cool, wet it with water. Then, with the tweezers, gently bend back the foil from the edges, by slow degrees, and it will usually strip off in one piece. If any shreds of gold remain, remove them with a fine excavator.

"**Setting the Inlay.**—The filling should now fit the cavity perfectly, and not rock nor move when in place. The edges should be absolutely exact, so as not to be perceptible to the naked eye. Make sure that the occlusion is correct, and then, keeping both inlay and disc thoroughly wet, cut grooves, with a small diamond disc, in the most favourable positions on the inside of the filling. If dovetailed grooves, so much the better. The smallest corundum discs are too large and soft for accurate grooving, except in very large fillings. Now dry the cavity perfectly, and, with a small bur or excavator, cut out a little dentine from the cavity, so as to gain space for a little cement nearly everywhere, except at the edge.

"Be sure to understand the character of the phosphate cement used. Almost any good phosphate will answer, but the operator must be familiar with its working. It is important to mix the cement to that consistency which will allow every atom of surplus to be squeezed out, and yet be hard enough to hold the inlay firmly in place.

"Inlay and cavity being perfectly dry, a little cement should be smeared into *every part of the cavity*, as well as upon the bottom and sides of the inlay, especially in the grooves, and a few seconds allowed for the cement to attach itself, when the inlay should be carried into place and gently pressed home. The surplus should be neatly removed from tooth and inlay, and care be taken that the filling is exactly in place, when the final pressure should be given with a bit of wood, by means of which a gentle elastic pressure is exerted until it is evident that the last remnant of the cement has oozed out. In approximal cavities a piece of tape or silk, or sometimes a piece of floss-silk, may be used in pressing the filling into place; but, after removing all the surplus, it will be most frequently found that the even pressure of a piece of wedge-shaped wood, applied gently but firmly to the centre of the filling, will bring it still more perfectly in position. It is well to leave the cofferdam in place until

DR. JENKINS' PORCELAIN ENAMEL—*continued.*

the cement has begun to crystallize, but, in cases when the dam is inapplicable, varnish should be painted over the inlay and thoroughly dried with hot air.

"At a subsequent sitting, any particles of phosphate which may have been still clinging to the tooth or inlay can be removed, when it will be found that the tooth is perfectly restored in appearance and usefulness.

"**Pivot Teeth and Crowns.**—A special melting cup is furnished for pivot teeth. The root to be pivoted should be prepared, in the usual way, with a platinum pivot and platinum cap and collar, or half collar, according to the case. The pivot should extend through the cap, far enough to be embraced by the pins of the tooth. It should be flattened, so the pins can be bent over the pivot to advantage, when the tooth has been ground and fitted. The spiral in the melting cup should be covered with the asbestos paste, and the pivot set in the spiral. The selected powder can then be placed upon the tooth and cap, and melted under the same conditions as in inlay work, except that more care must be taken in cooling. In case of a close bite, the pins and the greater portion of the pivot can be ground away with the surplus porcelain enamel until a perfect occlusion is obtained, and then, if desired, the whole can be melted again. By this method the colour of the tooth is perfectly preserved, and a far stronger tooth can be obtained than is possible through backing with gold and soldering.

"The gum colour is not to be painted on, as in other work, but laid on in a thin mass, and then melted over the visible portion of the band. In cases of short teeth, when the root is banded, the colour of the tooth, instead of gum colour, may be carried over the band. Long, single teeth, which are designed to be set on a plate with vulcanite, may sometimes be tipped with this gum colour to great advantage. Any ingenious dentist will discover many ways by means of which this material can be utilised in crown work, and it is offered to the profession in full assurance that its value will be apparent from the first, and that through experience it will be found indispensable both to practitioner and patient."

CONTINUOUS-GUM WORK.

A FEW METHODS OF MAKING FULL SETS WITH OUR HIGH-FUSING MINERAL BODIES AND GUM ENAMELS.

First Method.—After as perfect an impression of the mouth has been taken as it is possible to obtain, and the model and dies have been cast, a plate of No. 4 hard platinum (Ash's gauge) is swaged or struck up with a flanged edge all round, which serves as a support to the Mineral Body and makes it smooth and comfortable to the tissues of the mouth with which it comes in contact. This flanged edge is produced in the following manner : Before the zinc die is cast, a wall of wax is built up all round the outside of the model, up to where it is intended to bring the plate, and trimmed down with an inward slope towards the model, in the form of a flat shelf, so that when the zinc die and lead counter are cast the counter will have a convex ridge, the zinc a corresponding concavity, and consequently the edge of the plate will be turned over or flanged during the process of swaging or striking-up.

The same result can be obtained by soldering with fine gold * a piece of thin platinum wire on the extreme edge of the plate, but it is very much more difficult to do this than to form the flanged edge in the way described.

After the plate has been swaged or struck up, the teeth are backed with platinum and soldered to the plate with fine gold,* or attached by means of a length of platinum wire, which is better, as the wire lends strength to the Mineral Body.

It is then ready for the application of the Mineral Body, which is mixed as thickly as it can be worked, packed in between the teeth with a camel-hair pencil, built up on the labial side and contoured to the desired shape and thickness of the intended gum. It should be borne in mind that any shape or contour aimed at is made at this first stage with the Body ; the Gum Enamel is only a colouring agent, and should always be laid on thinly when it is applied. The palate should now be covered with the Body, and the whole of the work allowed to dry naturally. When thoroughly dry the case is ready for firing.

In order to obtain the greatest possible amount of strength in continuous-gum work, the *Body and Enamel should not be thoroughly fused or vitrified more than once.*

The best method of doing the work throughout is as follows :—

The first application of the Body mentioned above, on an upper or lower case, is only fired sufficiently to *solidify* the material. This permits of any defects in the building-up or contour being readily seen and rectified.

---

* Very little fine gold should be used—the less the better—in soldering platinum.

Exception has been taken to the use of fine gold for soldering platinum in continuous-gum work, on the ground that, as Gum Body and Enamel require greater heat to fuse than is required for melting fine gold, the joints are liable to open and the teeth to be displaced during the firing process, but a very important fact is overlooked by those who hold this opinion, viz., that in the union of the two metals the gold is platinized, which gives it a very much higher fusing point than fine gold *per se*, and thus renders it perfectly suitable for the purpose.

After the second layer of Body has been applied the case is again put in the furnace, and the firing is carried to the *biscuiting* stage.

The first layer of Gum Enamel is then thinly applied and fired sufficiently to slightly glaze it, after which any desired alteration in colour is made by the addition of a little more Enamel if the shade be too pale, or by grinding off a little if too dark ; the case is again placed in the furnace and *finally fired until it is thoroughly fused.*

The first three firings need careful watching to avoid vitrifying the materials. In the final firing the heat should be raised until a test portion of the Body fuses and balls up, which should be laid on a small nickel tray against the front of the case, and when the glaze is seen to appear on the surface of the case it is sufficiently fused.

The floor of the muffle should be covered with a thin layer of investing material in the form of dry powder.

A FEW EXPERIMENTS WILL ENABLE THE WORKER TO DETECT THE APPEARANCE OF THE GLAZE AND RENDER IT EASY FOR HIM TO DETERMINE WHEN THE FIRING IS COMPLETED WITHOUT THE USE OF A TEST PORTION.

These remarks upon firing equally apply to the second and third methods of making full sets, which are given below.

Second Method.—The special feature about this method is the use of diatoric instead of plate teeth. After the platinum plate has been swaged or struck up as described above, the diatoric teeth are waxed to the plate in the same way as for a vulcanite case ; three sections in plaster of Paris are built round the model and waxed case, one in front of the six incisors, one facing the bicuspids and molars on the right side, and the third facing the same teeth on the left side—each up to within an eighth of an inch of the cutting edges and crowns of the teeth. Of these sections the front one should be made first, and when it has set it should be soaped. The two side sections can then be made from one mix of plaster. If holes be cut, one on the front and one on each side of the plaster model, before the sections are made, corresponding knobs will be formed on the inside of each section, which holes and knobs will serve to keep the sections in position.

The case is then soaped, and a fourth section is built up on the top of the front and side sections and over the crowns and cutting edges of the teeth, which unites all and keeps them together.

The wax is now scalded out ; the platinum base is pickled in nitric acid, to ensure the thorough removal of any particles of lead which may have adhered to it from the dies ; the plaster sections are removed and lined with tissue paper (cigarette paper is the best for the purpose), the creases in which can be smoothed out with a camel-hair pencil dipped in vaseline. The tissue paper prevents the Gum Body sticking to the plaster sections during packing. The Body is now mixed fairly thick and packed in with a fine spatula and camel-hair pencils until an exact representation of the wax is reproduced. The Body is then applied to the palatal side of the platinum base, and the case is allowed to stand until it is thoroughly dry. This plan of drying naturally yields better results than drying and heating-up in the furnace, preparatory to firing. When thoroughly dry the plaster sections are removed and the case is taken off the model and

fired, after every particle of Body which may be found on the faces, crowns, or cutting edges of the teeth has been carefully removed.

It is possible after a little practice to make full sets with diatoric teeth, especially lower sets, without using plaster sections. This of course greatly simplifies the work, and admits of its being quickly done.

The following is a brief description of the manner in which such sets are made :—After the plate is swaged or struck up, a layer of Gum Body is spread over the alveolar ridge, put in the furnace, slightly heated, removed, and, while warm, fresh Body is added, and the teeth are placed in position one at a time. The warm Body absorbs the moisture from the fresh Body, causes each tooth to remain *in situ*, and thus permits of all being quickly set up. After this is done the case is put in the articulating frame, and when the bite has been obtained, any moisture in the Body is driven out by slightly heating in the furnace. When cool, the palatal surface of the plate is covered with Body, which should be scored in parallel lines with a spatula to prevent blistering ; the case is allowed to dry naturally, and when quite dry sunk in investing material on a nickel tray ready for firing.

If care be taken in firing, as described above, no alteration, but such as can be easily rectified, will be found to have taken place in the position of the teeth.

Third Method.—There are perhaps more difficulties in attaching a vulcanite base to a full set continuous-gum facing than in doing any other kind of dental mechanical work, but with care and experience such dentures can be satisfactorily made in this way : A frame plate is swaged or struck up to fit over the alveolar ridge and covering about half an inch of the palatine surface, to which small tags of platinum are soldered with fine gold, or loops may be made in the plate, with Peck's or Gartrell's loop punch, to afford a hold for the vulcanite. The teeth are then attached to the plate, just as on a full continuous-gum denture, a flat band or wire is fastened across the posterior end of the palate to the heels of the plate, to counteract warping, which would otherwise take place, in a case of this kind, under the extreme heat to which it is subjected. The Body and Enamel are then applied and fired, as already described under the first method.

In vulcanizing the following precautions are necessary : The flask should be as small as can be used, the object being to employ the least possible amount of plaster of Paris ; the various stages of flasking should be carried out without any long intervals between them, for if the plaster be allowed to harden and become dry, the subsequent softening in the vulcanizer causes undue expansion, and small cracks are made in the continuous-gum facing. On no account should the case be vulcanized on the model, but sunk in plaster in the flask. When the model is just hard enough to receive the rubber, it should be packed and placed in boiling water before the flask is closed ; *dry heat should never be used in lieu of boiling water.* Another fruitful cause of cracks in the continuous-gum facing is the contraction of the rubber while cooling, and for this reason it is always deemed advisable to make the rubber base as thin as possible, and to let the case remain in the vulcanizer until it is quite cold. When it is taken out of the flask it is placed in hot water for a few moments, and the plaster is removed from it with an old tooth brush.

MINERAL INLAYS.

(Introduced by Mr. Dall, of Glasgow.)

Left as they are moulded, for the dentist to grind and true to shape.

1. 2. 3. 4. 5.

Made in five different forms as here shown. A side view of each is given in the upper row of illustrations; the lower row shows the inner surface and the shape of each form.

Fig. 1 is for deep cavities in Molars and Bicuspids.
„ 2 is for shallow cavities on labial and buccal surfaces.
„ 3 is for oval cavities on labial and buccal surfaces.
„ 4 and 5, right and left, are for labial-distal and labial-mesial cavities.

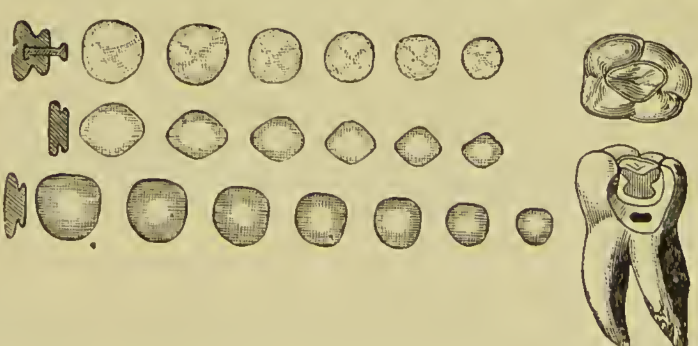
The inverted-cone Knobs are put on Figs. 1, 2, 3 to admit of their being firmly held while they are trimmed down to size, or either tried or fixed in the cavity. The Knob is ground off after the inlay is cemented in position.

		s.	*d.*
Price . . . . . . each 4*d.*; per pkt. of 25 assorted		7	6
„ . . . . per 100		30	0

PORCELAIN CAVITY STOPPERS,

FOR FILLING LARGE CAVITIES.

Left as they are moulded, for the dentist to grind and true to shape.



These are used in conjunction with Plastic Fillings, and will be found very useful in restoring teeth which are much decayed. They are made with smooth and serrated surfaces, and can be had with or without Platinum Pins. In a variety of shapes, different sizes as illustrated.

Price 4*d.* each, or 30*s.* per 100.

Section III.—PORCELAIN WORK.

PORCELAIN WORK.

GENERAL REMARKS.

Gas Furnaces.—To work efficiently under all conditions either the Crown and Bridge or the Full-Set Furnace with coal gas, a half-inch gas-supply pipe with clear bore tap is required.

Bellows.—Fletcher's size 5 Bellows should be used, and the rubber disc should be kept well inflated to ensure a strong steady blast. By starting with a gentle blast the work can be quickly and very successfully heated through in the Furnace before firing is fully commenced.

Cleanliness.—The utmost cleanliness is necessary to ensure success. Any wax or dirt on the back of the teeth must be thoroughly removed before the Mineral Body is applied.

Firing.—Great care must be taken to heat the work gradually in order to prevent flaking of the Mineral Body before the full power of the blast is applied, **and after the firing is done the work should be allowed to cool slowly**—the best plan is to leave it in the Muffle for a short time—so as to properly temper the Mineral Body and thus render it thoroughly fit for wear in the mouth. When a glaze appears on the surface it is sufficiently fired.

Roughness after firing.—If the Mineral Body be rough after firing, the roughness is due to its having been imperfectly fused. To remedy this it should be fired again until a nice glaze appears on the surface.

If it be porous, the porosity is due to its having been over-fired. When this is the case, as much of the porosity as possible should be ground out, new Body added, and again fired.

MINERAL BODIES AND GUM ENAMELS.

Full details of these will be found on pages 42–45. It should be noted that the Low-Fusing are prepared for Inlays and Crowns, and the High-Fusing for Bridges, Sections, and Full Sets.

PORCELAIN WORK—*continued.*

INLAYS AND CROWNS.

Time required for fusing.—Inlays and Crowns made from the Low-Fusing Mineral Bodies can be fired in from one to one and a half minutes.

The Low-Fusing Gum Enamel can be fired in a little under one minute.

Particular care must be taken not to fire the Enamel as much as the Bodies.

Neglect to observe this point will endanger the colour of the Enamel.

To make an Inlay.—See pages 27–32.

To make a Crown.—First secure the post to a flat tooth by bending the pins of the tooth over it, then mix some of the Mineral Body to the consistency of thick cream with the mixing liquid supplied for the purpose, apply a little of it about the post and fire it ; this will secure the post to the tooth, and constitutes the first stage of the process.

When the tooth is cool remove it from the Muffle, grind away the pins to prevent the expansion of the metal in the next firing, which would take place were they left in position, and build up with the Mineral Body until the desired shape is obtained. To avoid undue shrinkage of the Mineral Body, the moisture in it should be allowed to evaporate before the Crown is fired.

A post with a cap, similar to the one here shown, is secured to the tooth in the same way as the post without cap described above.

A post added to a collar, which has been fitted to the root by the operator, is also secured to the tooth in the same manner.

Collars and Caps.—To prevent the possibility of a collar or cap shifting during the firing process, it is advisable to solder it to the post with the smallest possible portion of fine gold.

How to Place the Work in the Tray.—In arranging a Crown for firing, the post should be passed through a hole that can be made at the back of the tray supplied for the purpose. Gum Sections and Bridges are supported on the tray with investing material.

PORCELAIN WORK—*continued.*

GUM SECTIONS AND BRIDGES.

Gum Sections and Bridges are made from the High-fusing Mineral Bodies and Gum Enamels. Before firing they should be dried naturally.

The remarks on firing, given in the fifth and following paragraphs under Continuous-Gum Work, on page 60, should be strictly followed.

Gum Sections are made by burnishing soft platinum foil into the space on the model where the teeth are missing. The teeth are then set up and supported on the platinum foil with investing material applied to the backs, and any excess that may squeeze through between the teeth is carefully removed. Another method, which is recommended in preference to the above, is to strike up a piece of No. 1 Platinum Plate (Ash's Gauge) in the usual way, to back the teeth and to solder them to it with fine gold; or the pins of the teeth may be attached to a piece of platinum wire which is soldered to the plate. The Mineral Body is then built up to the required shape, and the work is fired. After it has cooled down it is faced with Gum Enamel and again fired. Where much building up has to be done, it is necessary to do it little by little, and to fire the piece each time a fresh lot of Mineral Body is added. *See Notes on Firing Continuous-Gum Sets, pp.* 60–62.

Gum Sections with Vulcanite Attachments.—In reference to Gum Sections to which vulcanite is to be added: It is necessary, after flasking and packing, to proceed with the vulcanizing at once; if the plaster in the flask is allowed to stand for some hours and harden, the subsequent softening of the plaster through expansion is liable to cause small cracks in the enamel. Moist heat must be used for warming the rubber previous to closing the flask. The simplest plan of obtaining it is to put the flask in warm water and keep it there until the water boils. It can then be safely closed in the press and put in the vulcanizer. After the vulcanizing process the vulcanizer should be allowed to cool very gradually without blowing off the steam. *See further remarks under Third Method, on page* 62.

Bridges are made in the same way as Gum Sections, with this addition: the teeth are soldered to a platinum bar, which should not be thicker than Ash's A size wire, and also to any cap or pin that may be used before the Mineral Body is applied.

IMPROVEMENTS IN ASH'S METHOD OF MAKING THE MATRIX FOR IRREGULAR-SHAPED PORCELAIN INLAYS.

(*Reprinted from* Quarterly Circular, *December*, 1901.)

To save the readers of the *Quarterly Circular* the trouble of turning to back numbers, we make no apology for repeating such parts of the description of our method of making the matrix for irregular-shaped Porcelain Inlays, as are necessary to render it complete with the added description of the improvements which we have lately introduced.

Briefly put, the improvements are due to the substitution of Mr. Girdwood's dental lac for modelling wax for taking the impression, and of Spence metal for plaster of Paris for making the mould.

We have always been aware of the delay occasioned by having to wait for the plaster to set after the wax impression is embedded in it, and it has long been our aim to find a thoroughly reliable material that would answer as well as plaster and set quickly. Spence metal is such a material. It sets almost instantaneously, is very hard, practically non-shrinking, and yields such an exact mould that the finest marks from the cavity on the lac impression are reproduced in the mould. In our hands it has entirely superseded plaster of Paris for making the mould.

We have also always been aware that modelling wax is not an ideal material for taking the impression in certain cases, and Mr. Girdwood has put us and the profession under an obligation by the introduction of his dental lac, with which we are more than pleased. In addition to the uses of the lac mentioned by Mr. Girdwood in his paper,* we find it most excellent for taking impressions of cavities for irregular-shaped Porcelain Inlays.

Since we originated the method of taking the impression of the cavity in wax, embedding same in plaster of Paris, boiling out the wax and swaging foil in the plaster mould to form the matrix for the inlay—as distinct from the burnishing-in method—and first presented it to the profession, it has grown little by little towards perfection ; hence the instructions which we have given from time to time have necessarily been somewhat fragmentary and subject to change.

With the improved materials and appliances now at command we are so satisfied with the method, as it at present stands, that we feel sure the following description of it will be welcomed by inlay workers, especially if we can realise our desire to make it perfectly clear to all who read this paper.

By way of introduction we may state that the broad claim made for the method is that it is applicable in every case where an impression of the cavity can be taken, and that perfect fitting inlays can be made by it.

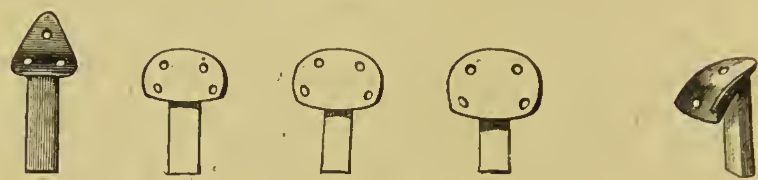
To make the method as plain and simple as possible, we will deal with each step in it under a separate heading.

To shape the cavity.—Shape the cavity without undercuts and give it some distinct form, so as to facilitate the fitting of the inlay when it is

* See *Quarterly Circular* for September, 1901, pages 273–277.

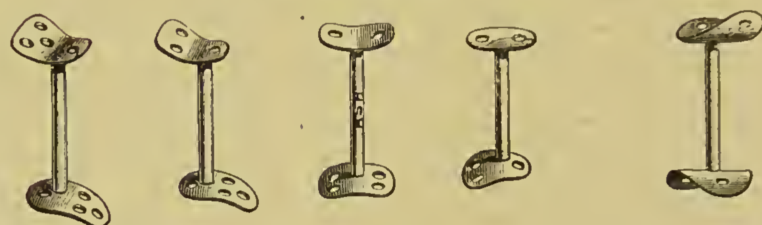
Inlays Impression Cups—all actual size :—

FIG. 1.



A. B. C. D. Side view of B. C. D.

MR. E. B. DOWSETT'S SET.



Nos. 1. 2. 3. 4. 5.

AA. and A.—Ash's small and large cups, with detachable handle.

B. C. D.—Small, medium, and large cups, in outline, suggested by Mr. J. Taylor Hughes, of Altrincham, for taking impressions of cervical cavities. The side-view on the right-hand side shows the shape of them.

Nos. 1–5, Mr. E. B. Dowsett's set. Mr. Dowsett thus describes them: "As seen by the drawings, the cups are ten in number, fixed together in twos by means of a short rod.* The object of fixing together in twos is that while one cup is being used the other at the opposite end forms a very convenient handle or buffer upon which one can push with extreme steadiness. After numerous experiments with various shapes and sizes, I have now reduced the number to these ten, which I find will meet the requirements of all cavities.

"Nos. 1 and 2 are for various ordinary interstitial cavities.

"Nos. 3 and 4 are for cervical and labial cavities.

"No. 5 is for interstitial cavities involving a considerable amount of the posterior portion of the tooth. The two cups on this one will be seen to be made right and left."

For description of Mr. Dowsett's Demonstration on "Inlay Work with Special Cups for Impression Taking," see pages 571–575 *of the Journal of the British Dental Association for October*, 1901.

AA.

* The illustrations show the cups as described by Mr. Dowsett and as submitted to us by him for manufacture. To render them quite suitable for use in the Inlay Swager we make each cup with a short pin that fits into a tube, by means of which the pairs can be kept together, used as stated by Mr. Dowsett, and detached from the tube at will.—C. A. & S.

ready for insertion. If the cavity be made ill-defined in form it is difficult to determine the proper position of the inlay for the cavity during trial and when conveying it to the cavity for cementing in position.

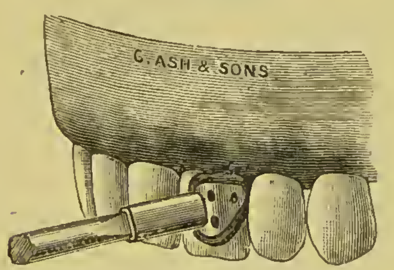
To take the impression.—Soften a small piece of dental lac in hot water or by waving gently over a spirit or Bunsen flame, place same in a suitable, warmed impression cup—see Fig. 1—and press it into the cavity as shown in Fig. 2.

In a few seconds the lac will be sufficiently hard to allow of easy withdrawal, without injury, from the most difficult cavity. When it is withdrawn, detach the cup—Fig. 3—from the handle, if a cup with handle has been used, or from the tube, if one of Mr. Dowsett's cups has been used, and lay it down where the impression cannot be injured until it is wanted for making the mould.

The cups are so constructed that the impression of a cavity together with part of the face of a tooth can be taken with them, which will serve as a guide for building up the mineral body to the proper contour.

For taking impressions of interstitial cavities the teeth must be separated like they are when such cavities are to be filled with gold.

FIG. 2.



Cup charged with lac applied to cavity.

FIG. 3.

Impression of cavity in cup.

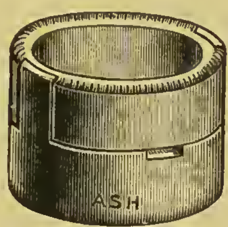
To make the mould in Spence metal.—First take the lower half of ring, A, Fig. 4, fill it with fine investing material, or preferably with Melotte's Moldine, press same thoroughly tight with the thumb, set cup with impression on same, as shown in C, Fig. 4; or plant the cup in the material pin downwards, if one of Mr. Dowsett's cups has been used for taking the impression.

Then place the upper half of ring, B, Fig. 4, in position, melt a little Spence metal, tilt the ring slightly, and pour down by the side of, *not direct upon*, the lac impression, just enough to run over it to form a thin shell, set the ring flat again, and settle the metal well into place by tapping the bench smartly with the hand. When this shell of Spence metal is cool, pour as much more upon it as will fill the upper half of the ring flush.

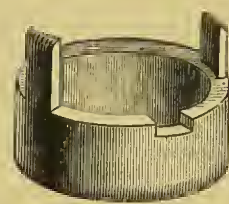
The two halves of the ring can be separated in about thirty seconds—that is, when the Spence metal has parted with its heat. *On no account must they be separated too soon, or the lac will drag; while, on the other hand, if not separated until the lac is thoroughly hard, there is danger of the edge of the mould being fractured.* Upon the lac impression being removed, there will be left in the upper half of the ring a Spence metal mould as perfect in shape, and with edges as sharp and well-defined, as the cavity in the tooth. (See D, Fig. 4.)

Spence metal.—It should here be noted that owing to the peculiar behaviour of Spence metal care should be taken to treat it according to the directions given below in paragraphs 2 and 3. It is throughout assumed that an ordinary ladle is used. With Mr. Christensen's ladle there

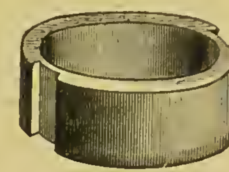
FIG. 4.



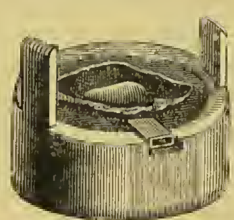
Ring complete.



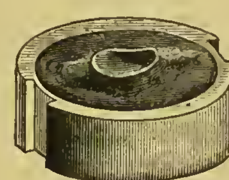
A.—Lower half of ring.



B.—Upper half of ring.



C.—Impression in cup upon bed of investing material.



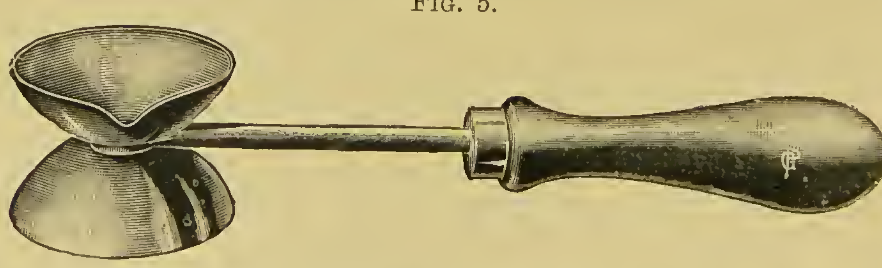
D.—Spence metal mould.

is no danger of burning the metal by holding the ladle too near the flame.

(1.) To prevent burning the metal and to obtain uniformly good results, the ladle containing it must be held some little distance above the flame until the metal melts.

(2.) When melted it has the appearance of a spongy mass, and must not be poured while in this condition, but placed on the bench in the ladle

FIG. 5.



Mr. Carl Christensen's small ladle, specially adapted for melting Spence metal. The dome-shaped base serves to confine the flame and prevents it reaching the metal.

and stirred with a stick until it settles down, becomes clear and free from bubbles.

(3.) During the settling down process it seems to stiffen before it finally liquefies. This liquid condition must be looked for, and when it appears the metal must be quickly poured.

(4.) With ordinary care no trouble will arise, but if the ladle is held so

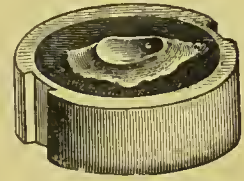
near to the flame that the metal burns, sulphurous fumes are given off which are objectionable.

To make the Matrix.—Take a piece of foil—gold or platinum for

FIG. 6.

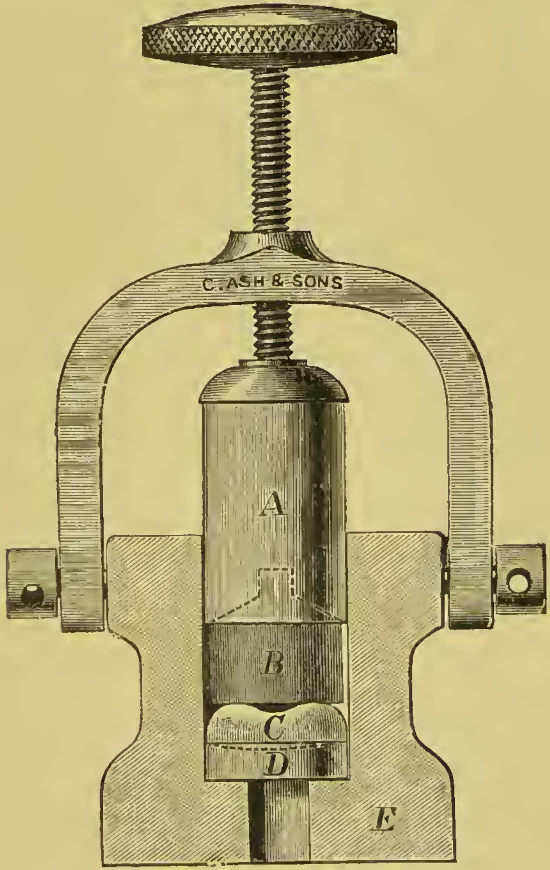
Gold or platinum foil with three V-shaped nicks cut in it.

FIG. 7.



Foil matrix swaged into the mould of Spence metal.

FIG. 8.



Ash's Inlay Swager—Two-thirds size.

A—Plunger; *B*—India-rubber water-bag, suggested by Mr. J. H. Badcock, of London; *C* and *D*—Plaster of Paris mould and bed-plate, superseded by Fig. 7, which is placed in the position occupied by *C D* in this illustration; E—Section of base, with hole in the floor for dislodging Fig. 7 after the plunger is removed.

low-fusing body, platinum only for high-fusing body—cut two or three V-shaped nicks in it, as shown in Fig. 6, to prevent the over-lapping of the edges, press it to the bottom of the mould with a piece of amadou, place the mould with the foil on it in the inlay swager (Fig. 8) and swage home. The resulting foil matrix is shown in Fig. 7.

NOTE.—It only occupies about eight minutes to take the impression, to embed it in investing material, to melt and pour the Spence metal mould and to swage the foil in the mould. No time to speak of is lost in waiting for the Spence metal to set.

To make the Inlay.—Mix Mineral Body—low-fusing or high-fusing—with the mixing liquid into a stiff paste, say to the consistency of new putty, build it into the matrix with a spatula, such as Flagg's, shown in Fig. 9, until it is quite full, and remove any moisture, which may be present, with white blotting-paper. Then cut out the entire depth of the Mineral Body in the centre of the matrix—be careful not to cut through the matrix—with a spoon, or other suitably shaped excavator. **The shape of the hole, made by cutting out the Mineral Body, should conform as nearly as possible to the shape of the matrix.** In firing, this hole will cause the Body to adhere to the walls of the matrix, instead of shrinking away from them towards the centre, as it frequently does when the centre is not cut out. Shrinkage is *greatly lessened* in large inlays if pieces of broken artificial teeth of the same colour as the Body are packed into it.

FIG. 9.

Flagg's No. 10 Spatula.

To fire the Inlay.—After the Body has been built in the matrix as described above, ease the matrix around the mould with Flagg's spatula (Fig. 9), or other suitable instrument; lift it out with tweezers, lay it on a bed of dry fine investing material in a nickel or platinum tray, and when the Body has dried, place the tray with its contents in the furnace, and fire to the biscuiting stage. *The matrix with its contents can then be replaced in the mould and re-swaged, to correct any little alteration that may have been caused by removing it from the mould or in the firing.*

The centre of the partially-baked inlay is then filled up with Body, the necessary contouring is done, and it is fired again to a nice glaze.

In some cases three firings will suffice, but in most cases four firings are required to make an inlay.

Should the colour of the inlay not match the tooth satisfactorily, it can be tinted to the desired shade with one or other of our porcelain enamels. This tinting should be done before the gold or platinum foil is stripped off the inlay.

FIG. 10.

Inlay after firing with foil stripped off ready for inserting in cavity.

If difficulty is experienced in stripping off the foil, it can readily be overcome by immersing the inlay in warm water. It should be stripped off from the edge towards the centre. A fine probe is the most suitable instrument for use in loosening the foil around the edge of the inlay.

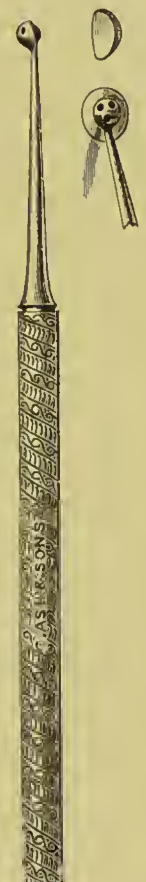
To fix the Inlay in the Cavity.—First, make any undercuts in the cavity that may be considered necessary. Before cementing the inlay in position, carefully serrate the back of it with a diamond disc, or, if it is

large enough, cut a groove all round it, to give it the form of a stud, instead of serrating it.

The serrations offer great hold to the cement in the cavity, and the groove serves the same purpose.

Next pick up the inlay with the conveyer (Fig. 11) so as to have it ready for insertion. If tweezers are used for picking up the inlay it is liable to slip out and be lost.

Fig. 11.



Inlay Conveyer charged with carrying cement, with an inlay to the right of it, below which the conveyer is shown applied to an inlay. The carrying cement holds an inlay quite securely until it is inserted in the cavity, when it leaves it most readily and with a clean surface upon being tilted to the slightest extent.

Then mix oxyphosphate cement quite thin, paint both the inside of the cavity and the back of the inlay with it, insert the inlay in the cavity, detach the conveyer and press home.

Fig. 12 shows a tooth with inlay inserted.

To prevent the inlay being slightly raised by the cement during the setting process it should be secured in position with an elastic band, or with floss silk, or with a wedge.

Fig. 12.

Inlay inserted in cavity.

Points to be avoided in making Irregular-shaped Inlays.—
Don't make undercuts in a cavity *before* taking the impression.
Don't over-fire an inlay.
Don't cement an inlay in position without either serrating the back or cutting a groove round it.
Don't grind the surface of an inlay.
Don't insert a badly-fitting inlay or an inlay of bad colour.

Advantages claimed.—We claim the following advantages for our method of making irregular-shaped inlays :—

(*a*) Saving of time and trouble to both patient and operator. After the cavity has been shaped without undercuts, an impression of it can be taken in dental lac, and all the work necessary for producing the inlay, from start to finish, can be done away from the mouth. The patient is thus spared the ordeal of sitting in the chair while a matrix is burnished into the cavity, and the operator can hand the lac impression to his assistant, from which the inlay can be made in the workroom.

(*b*) The gold or platinum foil is evenly and perfectly swaged into and around the edges of the Spence metal mould by means of the water-bag in the inlay swager ; an unalterable matrix is thus obtained. (If the mould of the cavity be a deep one, the very thin foil that is used may be torn inside by the pressure, but this is of no consequence provided the foil is intact around the edges, as the Mineral Body will not flow through the puncture during the firing process.)

(*c*) A foil matrix swaged in a mould is not liable to alter in shape during the firing of the inlay, because it is free from the springiness which results from the unequal pressure that is applied to a foil matrix burnished into a cavity by hand under amadou or cotton-wool.

(*d*) Swaging in a mould is so uniform that the matrix can be removed without that danger of slightly altering its shape, such as always attends the withdrawal of a matrix that is burnished into a cavity.

(*e*) The Spence metal mould remains intact for further use, should the colour of the first inlay prove unsatisfactory.

ASH'S LOW-FUSING OR HIGH-FUSING
COMPLETE MINERAL OUTFIT
FOR PORCELAIN INLAYS AND CROWNS.

NOTE.

Since this illustration was made the Outfit has been improved and enlarged.

Our aim in putting forward this **Complete Outfit** is to place in the hands of the Operator, especially the beginner, everything that is needful for Inlay Work, and thus to economise his time and labour.

Inlays and Crowns can be fired in any of Mitchell's Electric Furnaces, or in Christensen's Draught Gas Furnace, or in either of our Blast Gas Furnaces or in any other Furnace suitable for Porcelain Work.

The Platinum Foil supplied with the Outfit is specially prepared for Inlay Work. After numerous experiments we have succeeded in producing two Platinum Foils of just the right thicknesses for Inlay Work. They are annealed and ready for use as supplied.

ASH'S LOW-FUSING OR HIGH-FUSING
COMPLETE MINERAL OUTFIT
FOR PORCELAIN INLAYS AND CROWNS—*continued.*

During our trials we experimented with Platinum Foils of almost every degree of thickness, and as the result we can confidently say that Foil thinner than the thin Foil which we are now supplying is of little or no use for Inlay Work, for although thinner Foil can be more easily swaged, it is not strong enough to keep its shape under the movement of the Body during firing—the slightest movement pulls it out of shape ; moreover, it adheres so tenaciously to the Body that it cannot be stripped off after the Inlay is fired.

The thin Platinum Foil is intended for swaging the matrix into the mould for Incisor cavities and for small cavities in Bicuspids and Molars, and the Thick for large cavities in Bicuspids and Molars.

We may here mention that our LOW-FUSING MINERAL BODY, as now supplied, can be as successfully fired in a gold foil as in a platinum foil matrix.

EACH OUTFIT CONSISTS OF:

9 Half-oz. bottles Mineral Body.
1 ,, ,, Gum Enamel.
1 Bottle Mixing Liquid.
1 Bone Spatula.
1 dwt. Platinum Foil, thin or thick.
1 Glass Slab.
1 Set of ten Shades, which exactly match the materials in the bottles.
1 Ash's Inlay Swager.
2 Camel-hair Brushes.
1 Spatula.
1 Nickel Tray.
1 Sheet Amadou.

And the following Special Instruments, etc.

1 Diamond Bur, bud shape, for smoothing margins of cavities previous to taking impressions.
1 Ash's Diamond Disc, ¾-inch diameter, charged on both sides and on edge, for serrating Inlays before cementing in cavities.
1 Ash's Diamond Disc, ¾-inch diameter, charged on both sides but not on edge, for contouring Inlays, &c.
2 Huey's Mandrels for carrying the above Diamond Discs.
1 Ash's Polishing Stone, mounted, for smoothing the edges of Inlays after they are cemented in position.
1 Inlay Conveyer for carrying Inlays to cavities.
25 Polishing Buffs for finishing Inlays.
1 Screw Mandrel for carrying Polishing Buffs.
6 Wood Discs for polishing Inlays.
1 Split Porte-Polisher for carrying Wood Discs.
1 Tin Investing Material, useful for the following purposes :

(*a*) Covering the Nickel Tray to form a bed for the Plaster Mould in the first firing.
(*b*) Supporting the Foil Matrix, if it be removed from the Plaster Mould for the purpose of shortening the time of the second firing.
(*c*) Holding the Inlay should it require tinting with Porcelain Enamel to match the tooth. (For this class of work the Investing Material serves to protect the sharp edges of the Inlay and to prevent them becoming rounded by the heat.)

This Investing Material should be used as supplied, in the form of dry powder, in every case.

ASH'S LOW-FUSING OR HIGH-FUSING

COMPLETE MINERAL OUTFIT

FOR PORCELAIN INLAYS AND CROWNS—*continued.*

PRICES:

	£	s.	d.
Low-fusing Outfit complete, as above, in Oiled Walnut Case .	5	0	0

The shades supplied in this Outfit are as follows: *BODIES*—B/1 Light, B/2 Dark, B/3 Light, B/3 Dark, C/3 Light, D/2 Light, F/2 Light, E/1 Light, H/4 Dark; *GUM ENAMEL*—55B.

The fusing point of the Low-fusing Bodies is about 2000° Fahrenheit (1093° Centigrade), and of the High-fusing about 2200° F. (1205° C.). If properly fired, no alteration will take place in the colour of either the Low-fusing or the High-fusing, nor will they discolour in the mouth, there being no ingredient in them that can possibly bring about such a result.

	£	s.	d.
Smaller Low-fusing Outfit than the above	3	17	6
High-fusing Outfit complete, as above, in Oiled Walnut Case .	5	0	0

The shades supplied in this outfit are as follows: *BODIES*—NB/1 Light, B/1 Light, B/2 Dark, B/3 Light, BX/4 Dark, C/2 Light, D/2 Dark, E/2 Light, F/2 Dark; *GUM ENAMEL*—159B.

These Bodies and Enamel are ground very fine and yield the nice, smooth glossy surface which is so greatly appreciated in Inlays and Crowns.

	£	s.	d.
Smaller High-fusing Outfit than the above	3	17	6

Separately:

		s.	d.
Low-fusing or High-fusing Body, any shade .	per ½-oz. bot.	3	0
,, ,, ,, Gum Enamel . .	,, ,,	5	0
Platinum Foil, Thin or Thick	per dwt.	5	0

In ordering, be careful to state whether the Low-fusing or the High-fusing Outfit is required.

EXTRAS:

		s.	d.
Spence Metal—Sulphide of Iron—in Powder	per lb.	1	0
Inlay Impression Cups:—			
Ash's Small and Large, with handle complete. (See page 2) .		3	6
Hughes' Small, Medium and Large, with handle. (See page 2)		4	9
Dowsett's in pairs, set of 5. (See page 2)	per set	7	0
,, ,, separately	each	1	6
Ash's Moulding Ring. (See Fig. 4, page 4)	,,	1	6
Christensen's Small Ladle. (See Fig. 5, page 4) . . .	,,	3	0
Flagg's No. 10 Spatula. (See Fig. 9, page 6)	,,	1	3

DENTAL IMPRESSION LAC.

Prepared from the formula of

Mr. JOHN GIRDWOOD, D.D.S. Univ. of Penn., L.D.S. Edin.

Mr. GIRDWOOD finds the Lac a most excellent material:—

1. For taking impressions in crown and bridge work.
2. For taking impression and bite at the same time.
3. For holding loose teeth steadily while grinding or scaling them.
4. For supporting loose and tender teeth when filling.
5. For supporting teeth which are affected by pericementitis, and which have to be opened up.
6. For steadying separators and clamps as mentioned in "Dental Cosmos," vol. 36, page 12.
7. For filling in the hollow surfaces of crowns in polishing, to prevent possible bending of caps or pins by the mechanical assistant.
8. For making up special trays in Prosthetic work.
9. For stopping the bite at a given height in Prosthetic work.
10. In alcoholic solution for filling root-canals.
11. For mending broken plaster models. In alcoholic solution it is an admirable cement for this purpose.

See his Paper in the "Dental Review," reprinted in the September, 1901, *number of our Quarterly Circular.*

As a substitute for Modelling Wax for taking Impressions of Cavities in Inlay Work, we find it the best material that we have ever used.—C. A. & S.

PRICES:

		s.	d.
Dental Impression Lac, in cakes, as illustrated . . .	per lb.	5	0
,, ,, in alcoholic solution for filling root-canals,	per bot.	1	0
,, ,, ,, for mending broken plaster models	,,	1	0

ASH'S

PORCELAIN ENAMELS

FOR SHADING MINERAL TEETH AND INLAYS.

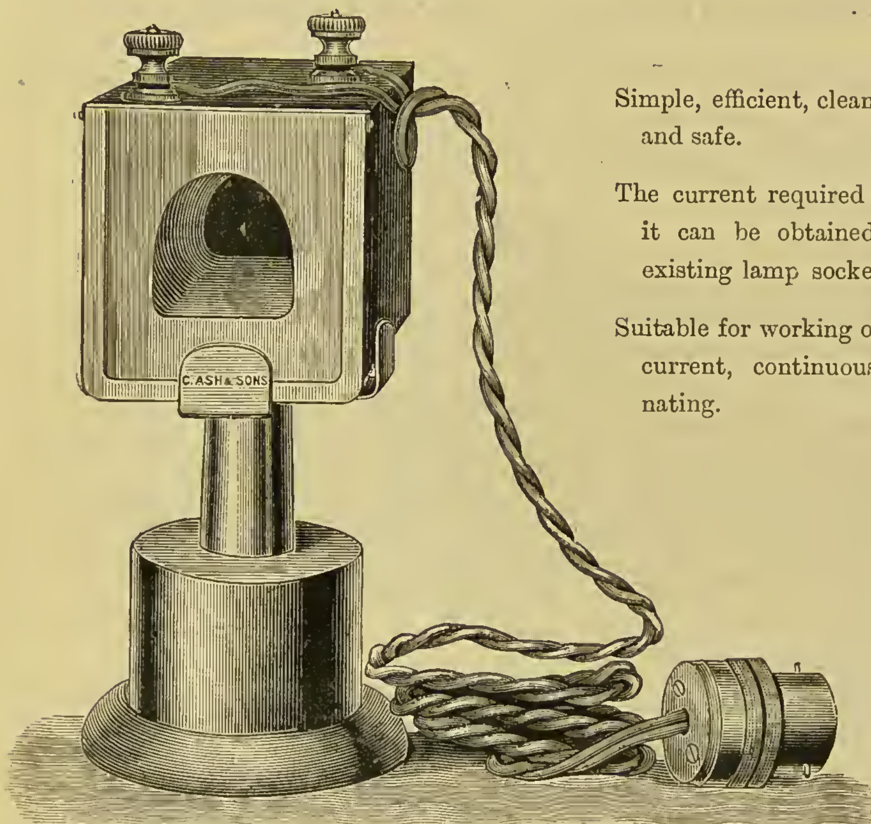
These Enamels are ground beautifully fine, can be fused on any make of teeth, and are warranted not to wear off in the mouth. When properly fired, they will stand any test to which they may be subjected, either in soldering or vulcanizing.

PRICES:

	s.	*d.*
Box containing eight bottles Porcelain Enamel—White, Grey, Blue, Dark Green, Dark Brown, Light (Italian) Brown, Black and Yellow—one bottle Mixing Liquid, Porcelain Palette, Bone Spatula, two Camel-hair Pencils, and Nickel Tray, complete	16	0
Gum Enamel, for veneering the cervical border of Inlays and Crowns, No. 55B . . . . per $\frac{1}{4}$-oz. bottle	2	6

MITCHELL'S No. 1 ELECTRIC FURNACE

FOR INLAYS AND CROWNS.



Simple, efficient, cleanly, noiseless and safe.

The current required for working it can be obtained from any existing lamp socket.

Suitable for working on any main current, continuous or alternating.

ABOUT HALF-SIZE.

Inside measurements of Muffle, $2\frac{1}{4}$ inches long, $\frac{7}{8}$ inch wide, $\frac{7}{8}$ inch high.

	£	s.	d.
Price of Furnace with Door complete with Wires and Plug, Nickel Tray for holding the work, tin of Ash's Investing Material with directions for use, tin of Kaolin for repairing Muffle, with directions for use, and Card of Instructions for working the Furnace	2	2	6

The above price of 42/6 is charged for the Furnace wound for any current between 50 and 120 volts; if required for more than 120 volts the price is 52/6. We stock it wound for 100 volts and 110 volts.

In ordering, please state voltage for which it is required.

SMALL RESISTANCE

FOR THE ABOVE FURNACE.

For regulating the heat and conserving the Furnace. The Resistance should be screwed to the wall, or in any other suitable vertical position, so that the air can freely pass behind it and carry off the heat generated.

Directions for Use.—To warm up the Furnace, set the pointer level with the third rib from "off," and when thoroughly warmed advance it as far as it will go towards "on."

To cool down, bring back the pointer to the second rib from "on," leave it there for about half a minute, then set it level with the fourth rib from "on," and when the Muffle is cool enough switch off the current.

	s.	d.
Price of Resistance	12	6

CHRISTENSEN'S

DRAUGHT GAS FURNACE

For INLAYS, CROWNS, and BRIDGES.

(Registered. Reg. No. 362,761.)

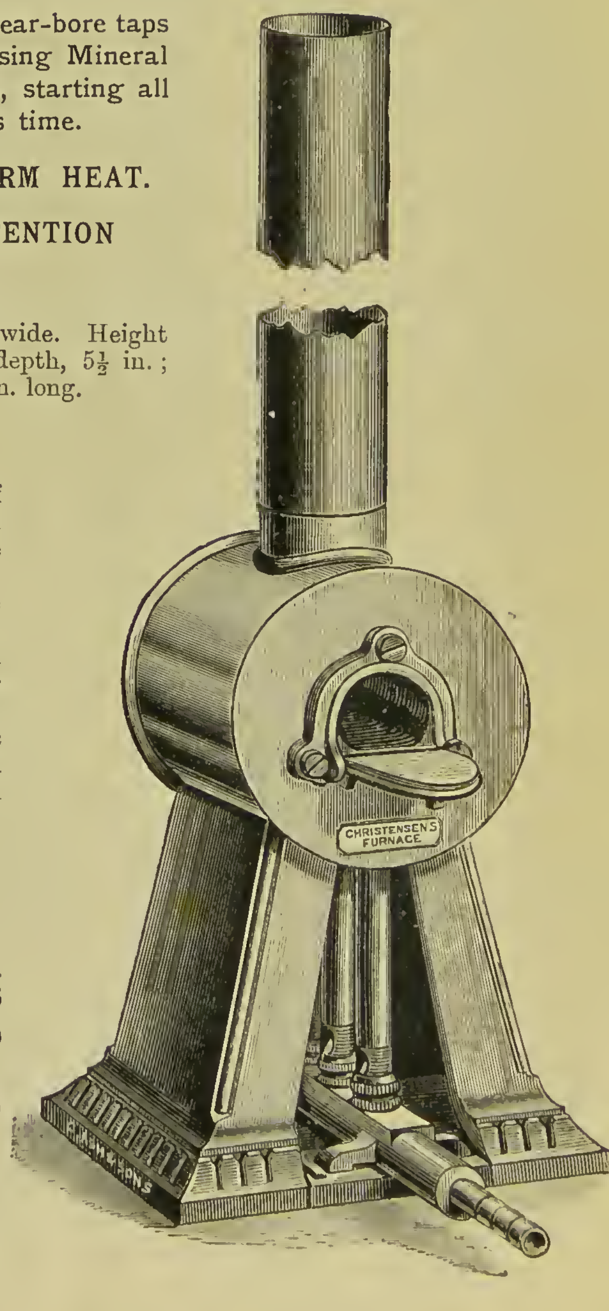
NO BLOWER REQUIRED.

With a half-inch gas supply and clear-bore taps the Furnace will fuse our High-fusing Mineral Bodies in from four to five minutes, starting all cold—our Low-fusing in less time.

GIVES A PERFECTLY UNIFORM HEAT.

NEEDS NO UNUSUAL ATTENTION WHATEVER.

Muffle, 3 in. long; $1\frac{1}{4}$ in. high; $1\frac{1}{2}$ in. wide. Height of Furnace, $11\frac{1}{2}$ in.; width, 7 in.; depth, $5\frac{1}{2}$ in.; weight, $7\frac{1}{2}$ lbs. Chimney, 18 in. long.



DIRECTIONS FOR USE:

The Burner should be lifted out of the Furnace, lighted outside, and then put back; on no account should it be lighted from the top of the Chimney.

It should be turned full on from the commencement of firing.

When the firing is nearly completed the furnace door may be left open for the purpose of observing the work. Upon the completion of the firing the door should be closed again, and kept closed until the Furnace has cooled down.

PRICES:

	s.	d.
Furnace with Nickel Muffle and Nickel Tray, but minus Burner	57	6
Burner	8	0
Ash's Fine Investing Material . . per tin	0	9

Parts separately:

Nickel Muffle . . .	3	6
,, Tray	1	0

ASH'S FULL-SET DRAUGHT GAS FURNACE—*continued.*

Directions for Use:

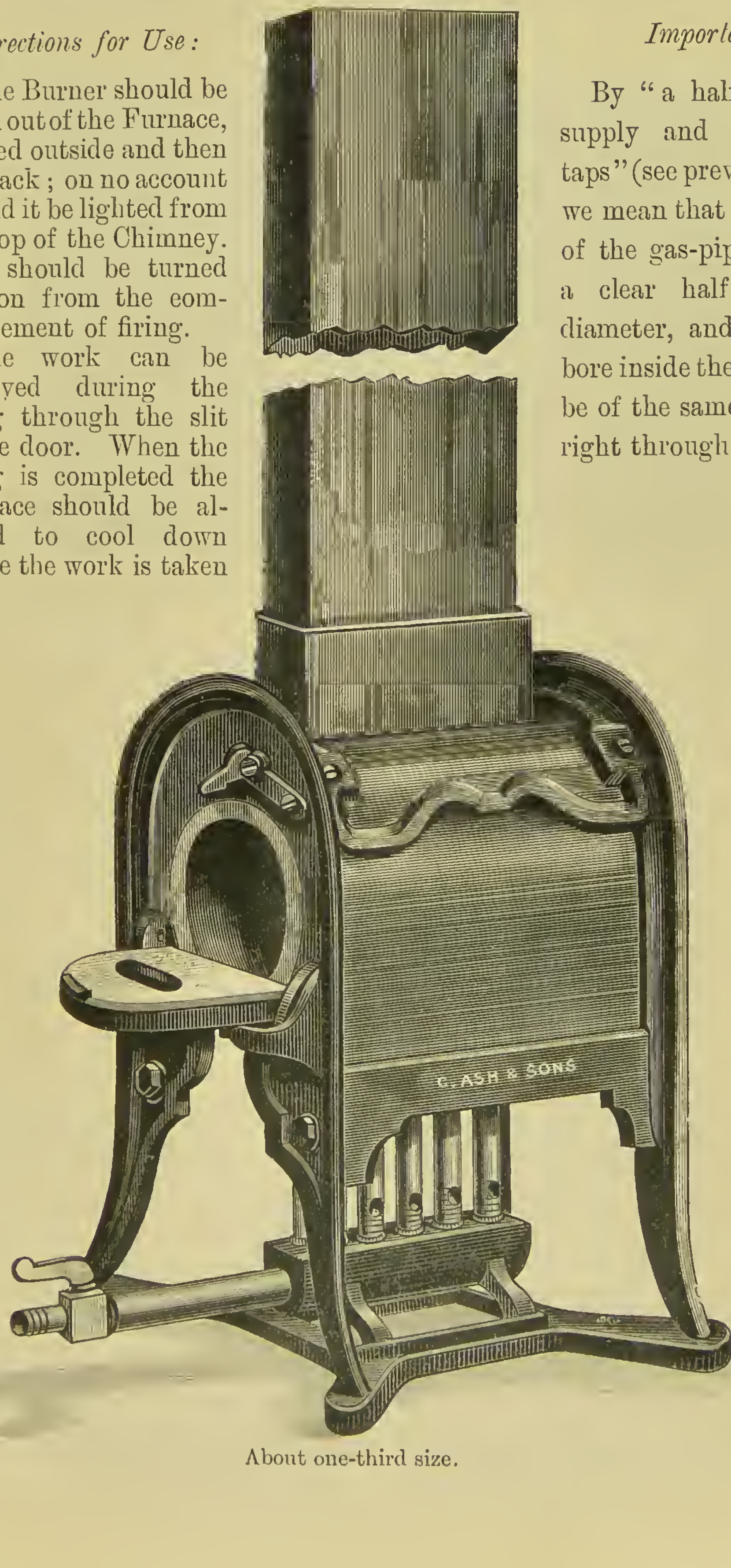
The Burner should be lifted out of the Furnace, lighted outside and then put back; on no account should it be lighted from the top of the Chimney.

It should be turned full on from the commencement of firing.

The work can be observed during the firing through the slit in the door. When the firing is completed the Furnace should be allowed to cool down before the work is taken out.

Important.

By "a half-inch gas supply and clear-bore taps" (see previous page) we mean that the inside of the gas-pipe must be a clear half-inch in diameter, and that the bore inside the taps must be of the same diameter right through.



About one-third size.

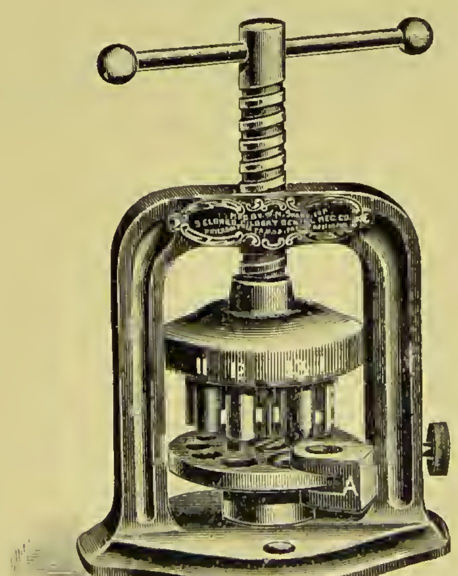
Dr. W. M. Sharp's System of Making Seamless Contoured Gold Crowns.

Dr. Sharp's system of making Seamless Contoured Gold Crowns is a radical departure from any other system heretofore employed, as will be apparent from the following description and working directions.

Within the last few months hundreds of the leading dentists have adopted it, and speak of it in terms of the highest praise.

Before interesting ourselves in the sale of the Outfit, we made a very searching examination into the merits of the system, and have therefore confidence in recommending it to the Profession for making Crowns, since it possesses all the needful advantages, viz., simplicity, accuracy, saving of time and of gold.

Fig. 1.



Draw-Press for Forming the Gold Shells.

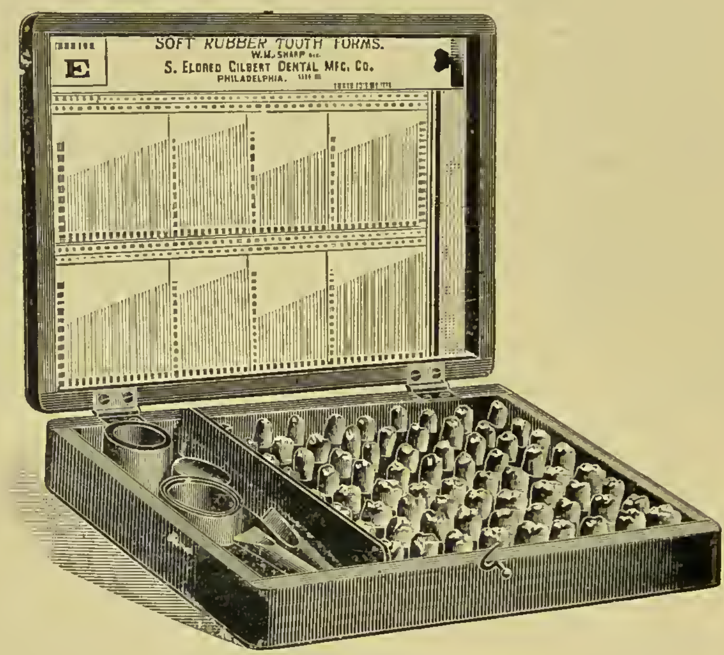
The Outfit consists of an improved Draw-Press, with a series of Punches (Fig. 1) for drawing out gold shells from discs for seamless crowns, like the shell shown in Fig. 6, and a set of flexible Rubber

Contoured Tooth Forms, with measurement table in lid of box, as shown in Fig. 2.

In this system two methods may be employed, and it is left to the dentist to decide in each case which is preferable.

One method may fitly be called the Rubber Tooth Form Method, and the other the Collar or Banding Method.

FIG. 2.



Box of Rubber Tooth Forms, with Measurement Table and Accessories.

Very full instructions are given for making crowns by the Rubber Tooth Form Method, on the assumption that such details of them as are necessary will be applied when following the instructions given for making crowns by the Collar or Banding Method.

The notes under the heading **General Information** will be found most useful by all who adopt Dr. Sharp's system of making Seamless Gold Crowns.

It may here be mentioned that the Rubber Tooth Forms have been very carefully chosen as typical teeth, and that their selection is the result of long experience; in many instances they will be found excellent models from which crowns can be quickly made in cases where there is little or no occluding surface to consider.

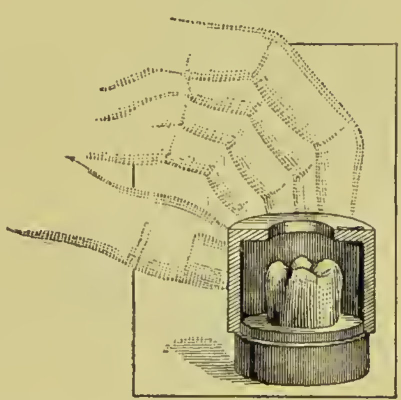
The above illustration very imperfectly shows the contour.

THE RUBBER TOOTH FORM METHOD.

INSTRUCTIONS FOR USE:

Prepare the root in the usual way to receive a crown. Take the measurement of the root with wire and a dentimeter, or by any other method. Carefully remove the wire from the root, cut it, straighten it out, and place it upon the line which corresponds to it in length, under the proper heading, in the measurement table in the lid of the box (Fig. 2), this being the *inside* measurement of a crown made from the form. The number on the left of this line indicates the required tooth form; the first number on the right indicates the gold disc that will produce the crown of required size, and the next number indicates the size of the punch to which the shell must be drawn in the Press. Two measurement lines are given in the table for each form, the lower line being the measurement required for an ordinary crown, and the upper line the measurement for a shallow crown.

Fig. 3.

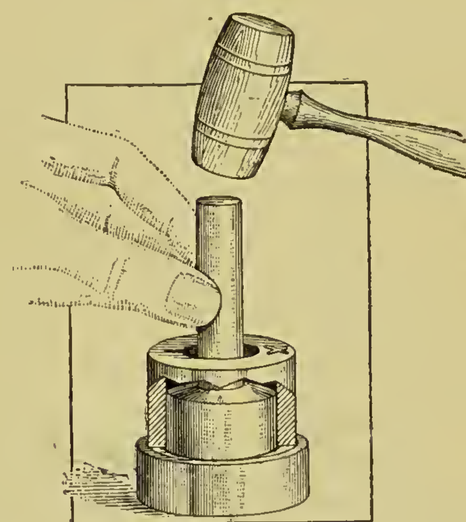


Rubber Tooth Form set on Rubber Base with Moulding Ring placed over it. To give a clear view of the Rubber Form, the Moulding Ring is shown in section.

PROCESS OF MAKING MOULD AND CROWN.—Having selected the Rubber Form, set it on the rubber base shown in Fig. 3, place the moulding ring over it (see Fig. 3), and pour Sharp's Fusible Metal into it. The ladle should be held a few inches above the ring when pouring the metal, and only Sharp's Fusible Metal should be used, as it has exactly the degree of hardness best suited to this work. Allow a few moments for the metal to become hard, then slowly work out the Rubber

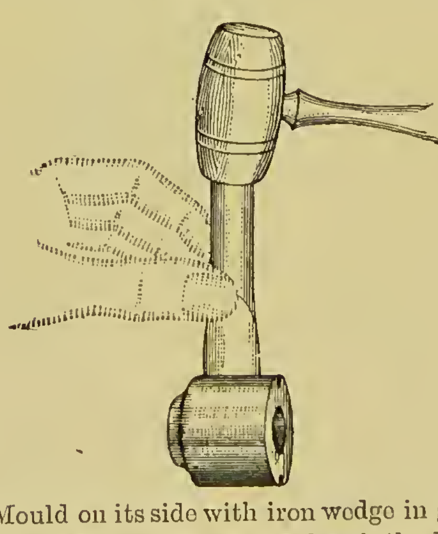
Tooth Form, grasping the pin with pliers, after which drive the metal from the moulding ring as shown in Fig. 4. Then place the iron wedge in the groove in the Fusible Metal Mould (Fig. 5), and strike it a sharp blow which will break it in half. *This should be done before the metal is quite cold.*

FIG. 4.



Shows how the Fusible Metal Mould is driven out of the Ring, which in this illustration is also in section.

FIG. 5.



Fusible Metal Mould on its side with iron wedge in groove, ready for the sharp blow to be given which will break the Mould in half.

PROCESS OF MAKING THE SHELL.—Select a disc of proper size, by reference to the measurement table, anneal it, place it in the countersink of the same size under punch No. 13 in Draw-Press (Fig. 1), and put

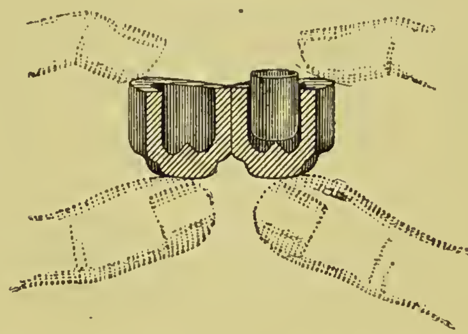
clamp *A* over it, as shown in Fig. 1. This clamp prevents buckling of the gold, and is only used for No. 13 size punch.

With the clamp in place, force the punch down through the hole in the die-plate, reverse the motion to strip off the shell, continue drawing down consecutively until the required size punch is reached, corresponding with the number in the measurement table, and anneal occasionally during the process of drawing.

FIG. 6.

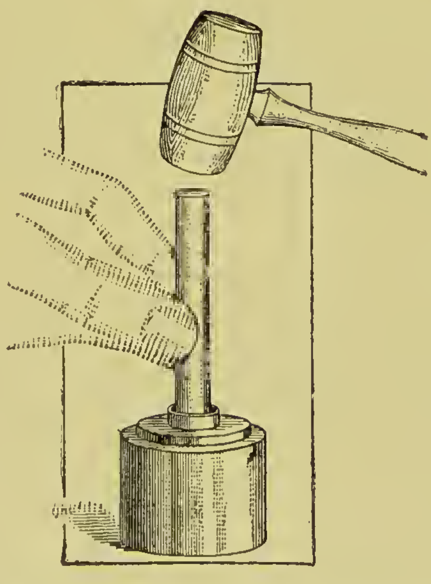
Shell made from Gold Disc.

FIG. 7.



The two halves of the Fusible Metal Mould with a Gold Shell laid in the right-hand half.

FIG. 8.



Gold Shell in Fusible Metal Mould fixed in Moulding Ring, with one of the Punches which is used on the Swaging Compound.

After annealing the shell, place it in one half of the mould previously made, as shown in Fig. 7, put the other half over it, and force the two halves together with the fingers sufficiently for them to enter the moulding

ring, exactly as the mould came out of the ring. A prominence on the mould serves as a guide for replacing it in the ring. See that the halves meet perfectly, and carefully tap down into position.

Place the ring with the mould on a solid iron or stone base, shape a piece of soft pine wood so as to fit the shell loosely; with a hammer drive it in carefully, and force the gold into the cusps of the mould (Fig. 8). When the cusps are fairly well formed, take out the stick, put a little warmed swaging compound in the shell, press it down, add more which must not be warmed, use one of the iron punches of suitable size, and with a hammer strike a few hard blows, which will force the gold to take the form of the mould (Fig. 9).

Fig. 9.

Fusible Metal Mould taken apart before the Crown is fully formed, to see how the work is progressing.

The mould may be occasionally opened to see that the cusps are being clearly formed (Fig. 9). When the cusps are sharp enough fill the shell with compound and swage again, so as to make it conform to the mould, and to expand it sufficiently at the neck. The result will be an exact duplicate of the model in a seamless gold crown, the cusps of which should be reinforced with solder before setting.

TO OBTAIN ARTICULATION.—After a crown has been made, if it is found a little too small at the neck, when fitting it on the root, enlarge the neck part of the mould by scraping it with a penknife, and reswage. The crown should first be trimmed to follow the gum line. Assuming that this is done, and it is still found too long, it may be shortened by cutting off an even strip all round until the teeth almost come together. When this is done, remove, anneal, draw it in a little with suitable pliers until it snugly fits the root, and then press it into position. Ask the patient to bite, and the opposing teeth will in most cases indent the metal sufficiently to produce satisfactory occlusion. Before finally fixing the crown on the root, reinforce the cusps by flowing a little solder into them with Borax and holding the crown over a Bunsen burner.

A good plan of adapting a crown to the shape of the root is to take a copper band, fit it to the root, remove it from the mouth and pour fusible metal in it. The result will be an exact duplicate of the root, when the

copper band is taken away, to which a crown can be shaped ready for insertion in the mouth.

With the large and varied assortment of Rubber Tooth Forms furnished with the outfit, fifty per cent. of the cases in practice can, with a little experience, be dealt with by their use, and crowns can be made in an incredibly short time.

In making central, lateral and cuspid crowns, form the shell as well as possible on the metal formers before placing it in the mould, after which use a soft pine punch and tap it down until the closed end touches the bottom of the mould. At the least sign of a break in the gold, flow the smallest amount of solder on the inside to prevent further breakage, and, after using the wood, follow on with the swaging compound.

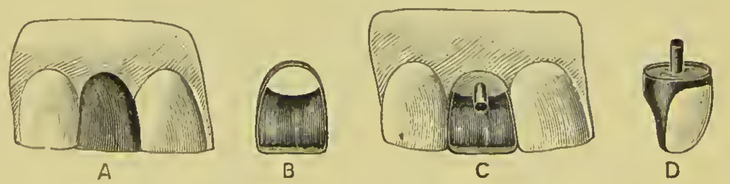
These forms are useful when making open-faced crowns for bridge work, and also for making window crowns, which is done by cutting out the front, as shown (Fig. 10 B), and fitting in a porcelain facing, backed with gold and soldered ; a post may be added if desired (Fig. 10 D).

TO MAKE ALL PORCELAIN CROWNS WITH BAND AND POST.

The central, lateral and cuspid Rubber Forms are particularly useful for making banded porcelain crowns with post by the following method :—

Select a suitable Rubber Form and make the crown of Platinum. Fit it properly to the root and gum margin ; when satisfactory as to fit, shape, and articulation (Fig. 10 A), remove it ; fit a Platinum, Iridium, or other

Fig. 10.



A B C D

metal post into the root canal, and allow it to project somewhat. Into the Platinum crown place enough wax or Lac to nearly fill it, soften slightly, and push it into position on the root and projecting post (Fig. 10 A). Take an impression of this and the adjoining teeth with impression composition, and when set, remove ; if the crown does not come off with the impression, it must be removed and put in place in the composition.

If the post remains in the root, remove, and put it in place in the wax or Lac in the Platinum crown.

Pour the impression with investing material; when set, remove the impression composition, warm the Platinum crown enough to soften the wax or Lac inside, so that the crown may be drawn away.

Remove all traces of wax or Lac from crown and model.

Cut out the face of the Platinum crown, leaving enough at the neck for a band (Fig 10 B). Cut away the sides and grinding surface to a considerable extent, and place the open-faced crown back into position on the model (Fig. 10 C).

Pack porcelain body of the right shade in and round the end of the post, and build it up to give the crown a proper form to match the adjoining teeth.

Place the whole model, reduced in size as much as possible, and well supported on pulverized silex, in the furnace, and biscuit it. When cold remove it from the model, fill up the cracks, and add enough body of the proper shade to give it the required fulness and contour; biscuit again by carrying the heat a little higher, but not high enough to glaze it. The exposed Platinum crown and pin should be embedded in a little granulated or pulverized silex during the firing. When cold any defects may be corrected, such as grinding off, or adding to, in order to obtain the proper form. It is then fired until it is glazed. When cold the Platinum must be polished, and if the collar or any part of the Platinum is likely to be seen, it may be gold plated before the crown is finally cemented into position (Fig. 10 D).

Crowns of this character admit of great possibilities, as a dentist can use his own ingenuity in bringing out the peculiar characteristics of the case; moreover, the method enables him to make a crown of unusual strength.

It is left to the dentist to decide in each case to what extent he will cut out the Platinum (this may be done with a file, a fissure bur in an engine, or ground out with a stone), prior to filling it with porcelain body.

The post must be as long as possible so as to be well fixed in the porcelain.

Dentists who decide to practice this method, are recommended to procure the Outfit G, as the assortment of forms is most complete.

With this Outfit a larger percentage of open-faced and window crowns may be made than with the smaller box of assorted forms.

THE COLLAR OR BANDING METHOD.

INSTRUCTIONS FOR USE:

The mode of operation is as follows :—

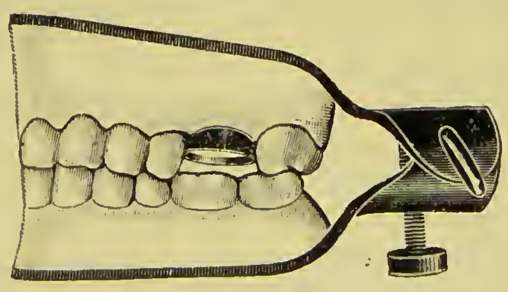
Prepare the root in the usual way to receive a crown.

Take the measurement of the root with wire and a dentimeter, or by any other method.

To this measurement make a band of copper or other metal and fit it carefully on the root in the mouth. (*Preserve the wire measurement for later use.*) The copper band must be of the same thickness as the gold employed in making the crown, viz., No. 30 American Gauge, $\frac{10}{1000}$, or easy No. 4 English Gauge.

Having done this, take an impression of the root and band, as well as of the occluding surfaces of the adjoining teeth, in one operation, by placing sufficient impression composition between the teeth and asking the patient to bite into it. When the composition has hardened sufficiently, remove it, and if the band does not come off with it, take it off and replace it in the impression ; thoroughly oil the inside of the band, pour plaster of Paris in both sides of the impression, and mount upon a small crown articulator. When the plaster has set and the composition is removed the band will appear as shown in Fig. 11.

Fig. 11.

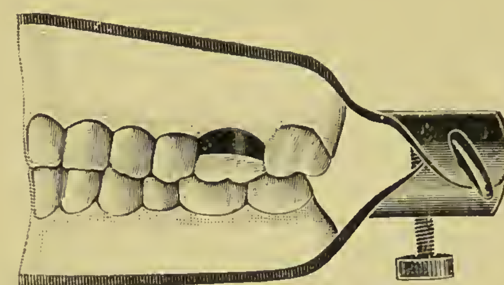


Copper Band on Root in Plaster of Paris Model.

Next proceed to oil everything thoroughly, *except the copper band*, which with care may be removed to facilitate the process of oiling the root. Having done this, replace the band in its original position, place enough freshly mixed plaster to more than fill the space within the band, and quickly close the articulator.

When the plaster has set cut away the excess with suitable tools and carve the cusps, so that when finished it will present the appearance shown in Fig. 12.

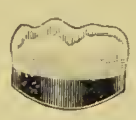
Fig. 12.



Banded Plaster of Paris Crown with the Cusps carved and articulated.

Remove from the articulator the crown thus formed, together with the band—Fig. 13 (this is easily accomplished by lifting the band from its position with the point of a penknife or other suitable instrument; and by removing it in this way the articulator is preserved on which to try the finished crown), push a small tack through the opening in the rubber base, allowing the head to remain fully exposed (Fig. 14), place over it a little plaster of Paris or Moldine, and set the carved plaster crown on it

Fig. 13.



Banded carved Plaster of Paris Crown with copper band.

Fig. 14.

Rubber Base with tack in position.

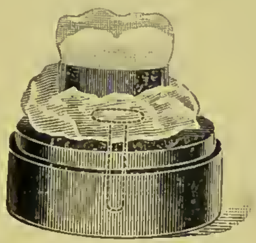
(Fig. 15). The plaster or Moldine should be trimmed sufficiently to expose all the copper band, so that when finished it will appear as in Fig. 16. Then with the point of a knife cut a thin groove all round the edge of the band to expose the thickness of the band (see A, Fig. 16). This line will be reproduced in the mould in the form of a rib or beading, and will consequently mark the gum line on the swaged gold crown to which it is to be trimmed.

It will now be seen that the model in this case has been made to an exact articulation or bite, and only needs to be duplicated, as in the case of the Rubber Forms, the process of which is identical with the details given for duplicating a Rubber Form (see Process of Making Mould and Crown, page 3, and Process of Making the Shell, page 4), except that the plaster

model and copper band, not being flexible, cannot be removed until the mould is broken apart.

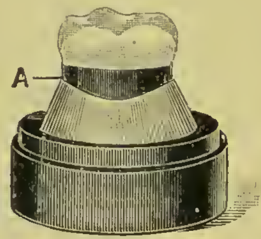
To find the right gold disc and the proper punch number to make the seamless cap for this case, compare the measurement which has been preserved with the nearest lower of any two given lines in the table of measurements in lid of box, at the right side of which will be found,

Fig. 15.



Banded carved Crown planted on the top of the tack in Plaster of Paris. The dotted lines on the front of this illustration show the position which the tack occupies under the crown.

Fig. 16.



Plaster of Paris shown in Fig. 15 trimmed to expose all the copper band and the groove at A, which is cut all round the edge of the band.

first, the number indicating the size of gold disc necessary, and, secondly, the punch number to which it must be drawn in the Press.

It will be seen from what has been said that no allowance must be made for the thickness of gold in this Collar or Banding Method, as the gold crown, when completed, occupies the same place in the mould that the plaster and band did.

GOLD DISC CUTTER.

Fig. 18 shows the disc-cutting device for use with Dr. Sharp's System. The frame of this device is of cast iron, with punches and dies of steel, nickel-plated. It is made to cut three sizes of discs, Nos. 16, 17, 18, these being the sizes most commonly used.

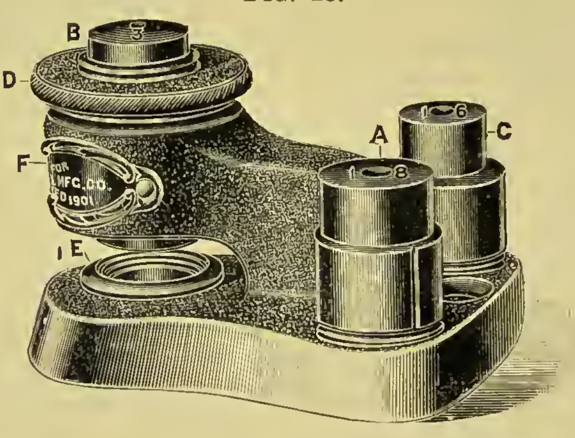
INSTRUCTIONS FOR USE:

Each punch has its size number on the cutting end A. The number on the other end, B, is that of the device itself, and is used at the factory for assembling the parts.

It will be noticed that each punch is grooved. This groove must be so placed in the head that it will be guided by the set screw in the head F.

When a disc of a certain size is wanted, insert the punch of that number in position in the head as directed, place the gold plate between the punch and the die E, so that the punch will rest entirely upon it. A sharp blow with a hammer on the punch will cut the disc. Should the punch be difficult to release with the fingers, screw the collar D on it until it is released. The disc may be removed by pushing it out of its position with the finger or with a suitable flat-ended stick of wood from the under side. The collar is only used to release the punch, and should not be on the punch when the blow is struck.

Fig. 18.



Disc-cutting Device.

The die E is stationary, and is made so that the three sizes may be cut in it.

The metal must be thoroughly annealed before the discs are cut.

The best position for the cutter is at the edge of the work bench over a solid support. A screw in the end in the hole provided, will secure it. After the cutting has been done, the cutter may be swung round, to clear the bench, so that the disc may be pushed up by the finger or piece of wood.

This cutter will be found most useful and economical, as the discs may be cut as needed, whereas without it it would be necessary for the dentist to keep a stock of the various sizes of gold discs; besides, an additional charge is made for the discs beyond the price of 22-carat gold plate.

GENERAL INFORMATION.

The largest countersink on the Draw-Press is No. 19, the next No. 18, etc. In all cases the drawing should be commenced with No. 13 punch.

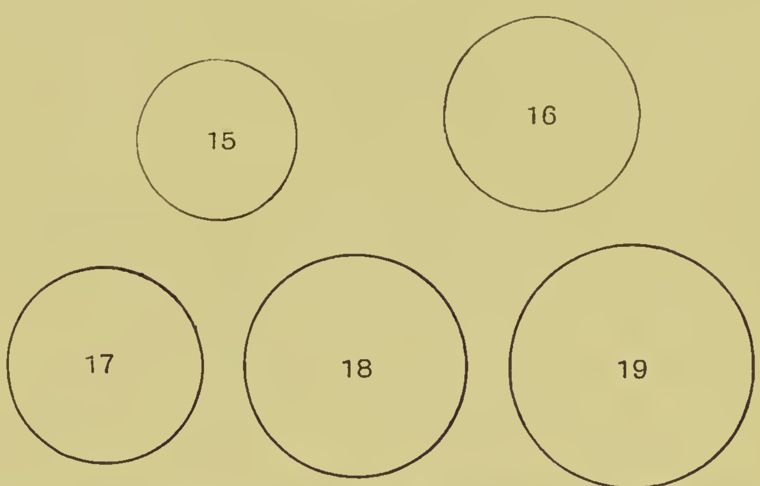
Each Rubber Tooth Form is numbered on its base and has its particular place in the box.

When annealing gold discs the oxide is quickly removed by immersing while hot in methylated spirit.

After a gold crown has been made in a fusible metal mould it should be immersed for a few moments in Nitric acid to remove every trace of the fusible metal.

In case a shell fails to be stripped from the punch in process of making, press the shell with the thumb while below the die-plate, and raise the punch until the shell comes in contact with the die-plate.

Fig. 17.



These circles show the five sizes of Discs which are supplied for making crowns by Dr. Sharp's system.

Throughout the process of drawing and expanding the gold should be frequently annealed.

The swaging compound may be removed from the crown by slightly warming. If the pine stick has so been forced in as to be difficult of removal, heat the crown to redness; this will char the stick, and thus allow it to be withdrawn.

The plaster model should be thoroughly dry before the fusible metal is poured upon it.

The Discs required for use in Dr. Sharp's system can be had in the five sizes here illustrated (Fig. 17) from the various Dental Dealers; but a Disc-Cutter, for sizes 16, 17 and 18, is furnished to order, at a cost of 25*s*. (Fig. 18), for the use of those Dentists who may desire to cut out their own Discs from sheet metal.

It is important that the gold discs used should exactly fit the counter-sinks in the die-plate, and that the edge of each should be perfectly smooth all round.

If the Rubber Tooth Forms become coated with metal, it is because they have been withdrawn too soon from the mould. The metal can be easily brushed off them.

If a gold shell should be torn during the process of swaging or expanding, a little gold foil or a pellet of gold pressed into the opening, with a little solder flowed over it, will sufficiently repair it until it has been articulated, after which it must be further reinforced.

In the Draw-Press the punch-head and die-plate revolve together, so that the punches to be used can be brought to the front. They can be fixed where desired, with the set screw shown on the right-hand side in Fig. 1.

The use of this Draw-Press results in a great saving of time and labour, because the number of punches has been reduced to the sizes actually needed.

By this method of drawing, the gold shell is of uniform thickness throughout.

Dr. Sharp's system will prove of great value to those who have not had much experience in crown-making, as, by following the instructions, the inexperienced, with very little practice, can make a crown as quickly and as well as anyone who has had years of practice.

In illustration of the saving of time which is obtained by the use of this system, it is only necessary to state that it has been so worked out that very little effort is required to produce a finished crown in from four to eight minutes, and that there is no scrap gold worth speaking of.

Oil should be freely used on the draw-plate and punches of the Press, as it will not only keep them free from rust, but make the work easy.

A simple way to lengthen cusps is to deepen them in the mould with a round engine bur.

By adding Moldine to the cusps of the Rubber Tooth Forms alterations may be made.

It is important that the wood used for forming the cusps be of the right grain.

Crowns are made so quickly from the Rubber Forms that it is a good plan to make copper crowns at leisure. This will give practice with the

outfit, and the copper crowns can be used as follows :—Assuming that a full set has been made and trimmed, stick each on a sheet of wax and below it mark its number. When a measurement has been taken, compare it with the chart, take the right size copper crown from the set, instead of the corresponding Rubber Tooth Form, try it in the mouth, make whatever alterations are necessary, and fit it with as much care as though it were to be used. Good occlusion is easily obtained by the patient biting into the soft copper crown. When it has been made satisfactory as to fit, etc., it may be passed to the assistant, who can mount it on Moldine, mark the gum-line (see A, Fig. 16), and then exactly duplicate it in gold.

Cusps for bridge work can be obtained by pressing the cusps of a suitable Rubber Tooth Form into molten fusible metal poured into the collar, *i.e.*, the lower part of Fig. 4. This gives an impression of the cusps, into which the gold may be swaged, by using a piece of lead or wood and hammering it in.

If a disc is not centred properly, the shell will be uneven in length. This may be corrected by so placing it over the succeeding holes. before drawing, so that the height of it, above the draw-plate, will be the same all round.

The illustration (Fig. 16) is a little imperfect, as it shows too great a depth of plaster between the bottom of the band and the rubber base. It is better not to have more plaster than is needed to trim nicely under the band.

The fusible metal mould will break more easily and much cleaner if broken while warm than when cold.

When pouring the fusible metal do not have it too hot.

PRICES.

	£	s.	d.
Set G—Consists of Draw-Press and an assortment of 144 Rubber Tooth Forms of Centrals, Laterals, Canines, Bicuspids, and Molars, with Punches, Fusible Metal, 2 Rubber Blocks, 2 Moulding Rings, and a supply of swaging compound and Copper Discs . . .	8	6	8
Set F—Consists of Draw-Press and an assortment of 72 Rubber Forms, comprising Centrals, Laterals, Canines, Bicuspids, and Molars, with all the accessories in Set G	6	5	0
Set E—Consists of Draw-Press and an Assortment of 72 Rubber Forms of Bicuspids and Molars only, with all the accessories as in Set G	6	5	0
Box D—Consists of an assortment of 72 Rubber Forms, comprising Centrals, Laterals Canines, Bicuspids, and Molars	3	2	6
Disc Cutter, for cutting out three sizes of Discs, viz., 16, 17, 18, shown in Fig. 18	1	5	0
Swaging Compound . . . . . per pkt.	0	1	0
Fusible Metal . . . . . . per ingot	0	1	3
Box containing an assortment of wood pins of suitable size for swaging (soft American Pine)	0	1	6
Annealed polished sheet Copper, suitable for bands, per pkt. .	0	1	0

Set G is the Outfit complete.

Set F contains one-half of the forms in G. A dentist purchasing this set can complete the Outfit later by procuring Box D, which is the other half of Set G.

Set E is made up of 72 Bicuspid and Molar forms only, taken from Set G. It does not contain all of the Biscuspid and Molar forms in Set G.

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